TELEPHONE ENGINEER

VOLUME 27 APRIL, 1923 Number 4

Whenever Hand Operation Is Replaced by Machinery—

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Automatic operation of a telephone system does more than merely save operators' salaries. It takes the guesswork out of telephone service by making it uniformly and unfailingly rapid, accurate and reliable.

When you install Strowger Automatic equipment you will have the pride and satisfaction of knowing you are placing at the service of your subscribers the very best and most modern telephone equipment available. The efficiency and operating economy of Strowger equipment will give you steady and certain profits.

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THE No. X69 WITH ENCLOSED GONGS

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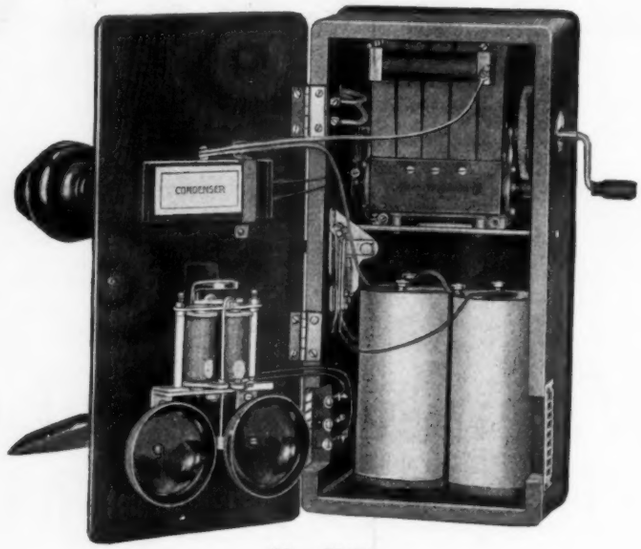

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CHICAGO, U. S. A.

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TELEPHONE ENGINEER April, 1923. Volume 27, No. 4. Published monthly by TELEPHONE ENGINEER. Publication office, 28 E. Jackson Blvd., Chicago, Ill. Subscription price $2 a year in the U. S. Entered as second class matter June 6, 1922, at the Post office at Chicago, Ill., under act of March 3, 1879.

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VOLUME 27 APRIL, 1923 Number 4

Relaying Radio Broadcasts

A Possible Telephone Service of the Future May Be the Relaying of Radio Broadcasts. The Telephone Network Offers Only Suitable System for Operation of Wired Wireless

By J. B. RATHBUN

It is the consensus of opinion among manufacturers and dealers in radio apparatus that the sale of high power vacuum tube radio receiving sets is nearing the saturation point and that at least 80 percent of the first-time sales of the more elaborate sets has already been made. Of course, there will always be replacement and "substitution sales" to be made, a certain percentage of the public always tending to change from one type of set to another, but in general the prosperous introductory days are over for the large stuff. The field for the crystal detector receivers and similar cheap apparatus has likewise become nearly exhausted in large centers or communities within 20 to 25 miles of the broadcasting stations, since this distance is about the limit in range of the smaller receivers.

However, there still remains a virgin field for the radio industry, and probably also for the telephone companies in the rural districts which are at present too far away from the broadcasting stations to make use of the simple outfits. This assumes that it is possible to bring the radio waves of the distant station within the range of the crystal detectors and small tube detectors by means about to be described. Tens of thousands of farmers and others living in isolated districts are still possible purchasers of equipment costing from ten to twenty dollars, providing that they can be assured of getting daily service in the reception of market reports, concerts, speeches, and the like. If such service can be performed, and it seems that there should be no reason why it should not, then we have opened before us a class of purchasers from ten to twenty times greater in number than those who have already been equipped. While this is not exactly a new proposition, yet it is at present receiving impetus from H. Gernsbach of the Radio News, who is advocating in one way or the other means for extending broadcasts.

In general, the proposition involves a single high power receiver which acts as the "Central" for a community, this receiver catching the faint waves from distant stations and then relaying them to proper strength and rebroadcasting them for the benefit of those living in the immediate vicinity of this receiver. In short, this station is a combined radio receiver and radio transmitter, having sufficient broadcasting capacity to cover a radius of from 25 to 30 miles, or a radius sufficiently great to include cheap insensitive crystal detectors and single tube dry battery outfits. Such service could be paid for by the profits on the sale of the equipment, from the rental of the receiving outfits, or in numerous other ways, and while the profits would not be likely to support an independent station maintained for this purpose only, yet it would undoubtedly prove a profitable side line for local telephone exchanges, lighting companies or the like.

Confining the Broadcasts

At first glance it would seem that it would be difficult to confine the local broadcasts to the paying clientele of the relaying station, since anyone within its radius could listen in undetected, but the writer believes that this would work out its own salvation for the reason that the "deadheads" would be caught with useless and expensive apparatus on their hands if the local station was unable to continue because of lack of patronage. There is no doubt but what the paying patrons would take matters into their own hands if things came to a show-down, and thus the listeners with mail order outfits could soon be brought to time. This is based on the supposition that the relaying station transmitted through the air directly as with any other station, but if the radio relaying were performed on the "wired wireless" system with the lines of the telephone company as a distributing medium, then it would be impossible for any except a patron of this company to subscribe to the radio service. For this reason, the telephone exchange is the logical "rebroadcasting" operator, for he and the lighting company are the only ones absolutely proof against infringement.

Concerning the actual means of rebroadcasting, there are a number of practical systems which can be applied. The first system, of course, is the direct rebroadcasting of the radio waves, the received signal being amplified and then rebroadcasted through the air in the regular way. This has the merits of simplicity, and is practical for the reason that standard radio sets can be used by the patrons. Its principal objection is its lack of privacy or confinement to the use of the patrons. The argument that it would interfere with local parties owning high power sets is baseless for the reason that the relayed waves can be sent out on a wave length of 150 to 200 meters, while the original broadcasted waves are received at standard wave lengths ranging from 360 to 485 meters. With even a single circuit tuner, there should be little or no interference with such a great difference in wave lengths, and at the same time the retransmitting would be well within the provisions of the law.

A second method, which is a variation of the above, would be to detect and amplify the waves to audio frequency, and then distribute the speech frequency current through the switchboard and subscribers' lines in the regular way. In other words, the concerts, etc., could be sent to the subscribers in just the same manner as in ordinary telephonic service without the use of any special radio apparatus at the subscriber's end of the line. Certain times could be set apart for the transmission of the broadcasts, and those who desired could listen in on their regular sets. This would require a specially powerful amplifying outfit, but is perfectly possible from the radio viewpoint. It has the advantage that the subscriber would be at no expense whatever, except for the service, if it were

considered advisable to make a charge for this service, but it has the disadvantage that the subscriber's line is tied up during this time, and that if on a party line, it would be likely to start something with those people who did not desire the service.

A third method, not impossible from an electrical standpoint but requiring special consideration in regard to the apparatus, is to distribute the broadcasts over the lines at radio frequency rather than at audio frequency as before. The incoming radio waves are amplified by radio frequency amplification and then are connected to the lines. Each subscriber wishing radio service has then only to connect his radio receiver to the telephone line which is used in place of the more common antenna. This offers the advantage that the radio frequency waves do not interfere with any telephone communication that might be going on at the same time on a party line, and therefore both the regular service and radio service could be given at the same time without interference.

Transmission of radio signals over light and power lines has been accomplished, but, so far as the writer knows, without practical success. There is always the hum of the alternating current and the crackle and rattle of load fluctuations to deal with, and these noises are disagreeable, to say the least. Personally, he has listened in on a number of light circuit distributions, but has yet to find one that was not noisy or faulty in some other respect. So far as clear, noiseless transmission is concerned, the telephone line is the only practical "wired wireless" system in his opinion. Direct current lighting lines are free from alternating current hum, but possess other disagreeable noises such as commutator squealing, motor roar, and the irregular noise of slipping motor belts. An overloaded motor with a slipping belt can drown out the loudest broadcast.

Freedom from Disturbance

Of all the methods given, rebroadcasting with radio frequency waves over a telephone line seems to have the greatest advantages. Such a system is not so subject to disturbances in the line which would seriously interfere with transmission at audio frequencies. As the radio frequency waves average about 833,000 cycles per second, they do not interfere with the telephone receivers or other standard telephonic equipment. In fact the radio waves are inaudible without rectification by a suitable detector. They are not subject to short circuiting through the subscriber's sets owing to the great opposition offered to the radio frequency waves by even a small amount of inductance. The cost to the subscriber is comparatively small, for a crystal detector outfit works very nicely with wired wireless where the radio currents are amplified, and even then these outfits could be rented or loaned by the company as a special inducement for subscribing to the service.

The cost of the receiving equipment at the exchange is comparatively low, this consisting of an ordinary regenerative or radio frequency detector used in connection with a suitable amplifier. The size of the latter would, of course, depend upon the number of lines served, but under ordinary conditions it is not likely that the cost would be very great even with several hundred lines were the radio frequency system of rebroadcasting used. Broadcasting at audio frequency would require greater amplification, as then the amplifier would necessarily operate all of the phones directly.

Johnson Insists That Independents Get a Square Deal

Indianapolis, Ind.—J. K. Johnson, telephone engineer, who has appraised many telephone properties in Indiana, recently testified as an expert witness for the Indiana Public Service Commission in the rate case of the Indiana Bell Telephone Co. He said he had tested the service of many companies and had found the Independents ranked "as good as the Bell throughout the state." Rates of the Independents are generally less than rates of the Bell, he said. It appears the commission is undertaking to show that there is not a difference in service sufficient to account for the difference in rates. Mr. Johnson made it plain that he is not wielding any axe against the Bell companies, but that he believes the Independents should receive a square deal.

"It is an injustice," he says, "to permit Bell companies to earn on a 100 per cent increase in valuation over Independent companies having like conditions. If Independent companies can operate and maintain their plants and furnish as good, if not superior service to that of the Bell at a 100 per cent lower rate, why should they be compelled to fight a rate case through the commission for an insignificant 25 cent increase while the Bell company is permitted to get from 50 to 100 per cent increases, due to their method of operation. This is unjust and unfair, Mr. Johnson maintains, to those operating outside of the Bell organization.

Paris, France—All European countries are to be represented on a permanent international telephone commission. Development plans have been made.

NORTH CAROLINA

Special Report and Recommendation of Corporation Commission

Raleigh, N. C.—From the special report and recommendations which the Corporation Commission of North Carolina filed with Gov. Morrison of that state recently, we take the following extract pertaining to the commonwealth's telephones:

"How short has been the history of this utility was impressed upon us recently when we read of the death of Alexander Graham Bell, inventor of the telephone. In less than half a century, the telephone was developed from the experimental stage demonstrated at the Philadelphia Centennial Exposition to practically a world-wide utility, serving many millions of people, and supplying a medium for transacting a large part of the world's business. Perhaps the telephone should be styled the pioneer utility. Where its lines go, other utilities follow. The extent of the industry in North Carolina can be more readily comprehended when we realize that the 190 companies are operating 332 exchanges connecting 32,731 business and 63,706 residence phones, with 25,507 miles of wire, or more than a sufficient number of miles to run a continuous line around the world. From complete reports for the year 1921, the operating revenue for all companies was $3,679,695.31, against $3,335,575.01 operating expenses, leaving a net revenue of $344,120.20, or 3½ per cent on an investment of $10,486,400.00. It is not conceded that the undepreciated investment account of telephone properties represents their actual value, or that the apportionment of long distance revenue is made on a proper basis."

Big New Exchange Building Is Started in Brooklyn

New York, N. Y.—The New York Telephone Co. will build a $750,000 central office at Troy Ave., Carroll and Crown Sts., Brooklyn, to assist in serving the Bedford-East New York sections of that borough. The present structure will be three stories high, but foundations will be laid for a nine-story building. About January 1, 1924, the telephone company will commence installing the first of three central offices which the building is to accommodate.

United T. T., Sunbury, Pa., Auctioned to Bondholders

Sunbury, Pa. — Property of the United Telephone and Telegraph Co. was sold at public auction by W. B. McCaleb, receiver, to a representative of five-sixths of the bondholders. The price was approximately $525,000.

LINE AND DESK

Help! Help! Send in Your Contributions

We borrow this heading from "The Wake," a feature of the sporting page of the "Chicago Tribune." We used to think (after several unsuccessful attempts at "making the line") that contributors to the various columns of newspaper humor were fictitious characters who existed only in the fertile imagination of the column conductors. Since we have begun to conduct a department, which has to be filled every month, we have come to appreciate how much copy must be fed into the maw of a line-o-type machine in order to fill the allotted space, and we have come to realize how welcome are the few helpers who have come to our assistance. Whether or not the contributors to the humorous columns are real, those who have contributed to this department are real persons and real telephone men. The only trouble with them is that we need more of their kind.

When we had this department under consideration, we sent out a few letters to some of our friends and asked for suggestions as to what topics might be covered. We thought that the several heads around the TELEPHONE ENGINEER office might be able to supply at least a part of the material to cover topics suggested. When the replies began to come in we discovered that we did not have any corner on "telephone brains" and that there were many matters of concern to telephone men that we had scarcely thought about. We are going to give a list of just a few that were suggested:

Merits of Marlin and Metal Cable Hangers.

Phantom Circuits.

Electrolysis Where There Is No Trolley Current.

Cost of Maintenance Per Station Per Month.

Protection of Rural Cable and Rural Lines.

There are many others, and they cover as wide a range of subjects. Telephone men are asking for information on these subjects. Other telephone men have this information. Our business is to bring the two together—to serve as a clearing house for the industry. Won't you come to the rescue? "Help! Help!"

The Testman Dreams

The testman seeks his couch at close of day;
Like you and I, he burrows in the hay,
And looks with joy on hours yet to come
Ere he must rise and greet another day.

On wings of sleep he's wafted far away
Where dreams come true and varied fancies play,
Till, woven in the fabric of his dreams,
He hears again the echo of his day.

To toll line insulation tests he's led,
Pursuing zeros that have oftimes fled;
While vainly through the night he tries to dodge
The ghastly megohms crawling round his bed.

Anon, he wanders into fields anew—
A noisy circuit, crossed by a construction crew
Defied the effort of his Wheatstone probe,
And fire from his vocal organs drew.

Then spring prepares her verdant roundelay
Ere winter's failing grip is torn away.
The Sleet King comes and hits the ball for fair
And speech webs on the glittering landscape lay.

Released from dreams long ere the skies turn pink,
From slumber's pool his soul prepares to drink,
When jangling fiends incarnate, on his 'phone,
Inform that old Five Thousand's on the blink.

He dons his gladsome rags without delay,
And for the testboard, pronto, speeds away
With full intent the saving patch to swing
And finds—the darn thing really tests O. K.

—Glen Barry in "The Mouthpiece."

Effect of Condensers on Transmission

A subscriber asks a number of question regarding the effect upon transmission of using condensers in various places in a circuit of apparatus associated with toll lines. His first question asks what would be the effect on transmission of a condenser cut in series with the drop at an intermediate station over a through toll line. In this case, the effect of the condenser probably would be negligible. The loss in a 1,000-ohm drop, bridged directly across the middle of a long non-loaded toll circuit, would be in the order of .5 miles of standard cable. A condenser in series with the drop would change the loss so little that the change could not be detected.

The second question asks what effect on transmission might be expected if 2-mf. condensers are used in series with the ringers on a 50-mile toll line having ten stations. Here again, it is probable that the increased loss in transmission would be so small as to be negligible. There might be some advantage in having condensers in series with the ringers on such a line to facilitate voltmeter and bridge testing.

A third question deals with the use of condensers with phantom and simplex coils. The exact connections contemplated are not quite clear, but some of the general considerations may be given: As a general thing, condensers are used in any circuit where it is desired to permit voice current to flow and to prevent a flow of direct current, or where it is necessary to have an inductive coil in a circuit and it is desirable to provide a path for voice currents which is free from the retarding effect of the coil. As a general rule, a condenser of large capacity should be used when it is placed in a position where the voice current will have to pass through it but, if placed in a circuit bridged across the line where it is desired to keep out both direct current and voice current, the capacity should be as small as practicable. Thus the condenser between the two halves of the drop side of a phantom repeating coil could be relatively large, while the condenser in series with a bridged drop should be as small as practicable and still permit satisfactory ringing.

In certain high efficiency circuits, condensers of 4-mf. and 8-mf. are recommended. In general, the circuits using the higher capacity are approximately .1 mile of standard cable better than those using the lower capacity. This difference would scarcely be noticeable in an ordinary circuit, but might be important in extremely long haul transmission.—**Staff Contribution.**

Some Times It Pays to Be "In the Clear"—Usually Not

Marion and Bill used to work side by side.

Marion was a wide-awake, capable sort of chap, and he was careful to do nothing that would incur the displeasure of the boss. He seldom drew criticism, for when things began blowing up, as they occasionally do, Marion, with an unerring sense of foresight, was invariably found to be "in the clear." The shafts of the boss' anger passed over his head and on to those luckless ones who had blundered and were striving to right affairs.

Bill did not mind so much, and he had a way of assuming responsibility.

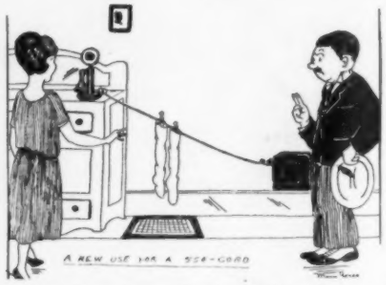
Bill thought a breach was something to be stepped into, and he frequently got his feet wet.

In times of aggravating circumstances, Bill was usually in there helping patch up, and when the smoke cleared away he took his part of the bawling out and let it go at that.

Bill is a boss now, for the powers that be grew accustomed to depend on him to Get It Done.

Marion works for Bill, and never gives any trouble—nor attracts any attention.—**Contributed by E. L. Smith, Ft. Worth, Tex.**

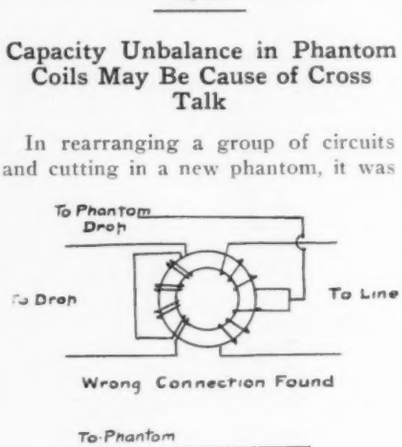
Bugs We Have Shot



This picture from "Bell Telephone News," illustrates what a Huntington (Ind.) repairman found on a line reported "permanent." What can you contribute in the way of an interesting or intricate case of trouble? Incidentally, what is wrong with the picture from a safety viewpoint? You are right, the telephone should not be placed near a grounded register

Capacity Unbalance in Phantom Coils May Be Cause of Cross Talk

In rearranging a group of circuits and cutting in a new phantom, it was found that cross talk existed between one of the side circuits and the phantom. The circuits had been carefully balanced and transposed and a test of the lines failed to show that any unbalance was present. The phantom coils were then checked out and it was noted that one of the coils was connected improperly. This happened to be the coil on the side circuit which was involved in the cross talk. In making the connections when the coil was installed, the line side of the coil was connected to the switchboard and the drop side was connected to the line, as shown in the diagram. When the coil was reversed so that the line coils were connected to the line and the drop side connected to the switchboard, the trouble disappeared.



The repeating coil was one of the type where the two windings on the drop side are wound separately and the two windings on the line side are wound in parallel. As the four coils showed the same resistance when measured with a bridge the trouble could not have been due to different resistance or to short circuited turns. The fact that the coil worked satisfactorily in every respect when connected properly indicated that the line coils were properly balanced and the conclusion was reached that there was an unbalance in the coils on the drop side which probably was due to unbalanced capacity. Although the exact cause of the trouble is uncertain, this little experience gave a convincing proof that care in following manufacturers' instructions may save much difficulty.

Contributed by D. E. Wass.

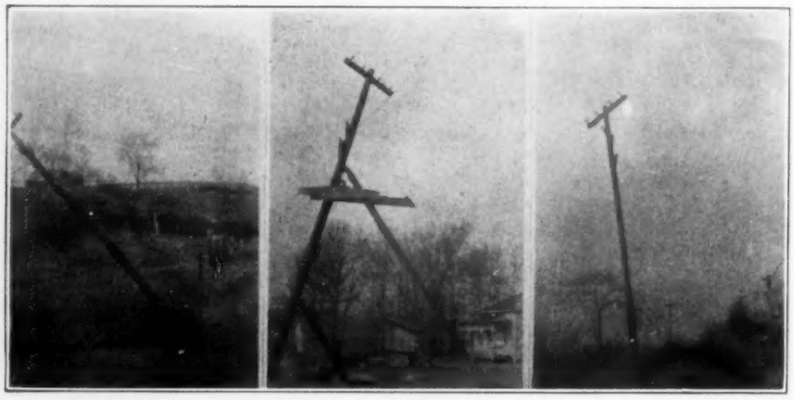
President DuBois of W. E. Sails to View European Chances

New York, N. Y.—Charles G. Du Bois, president of the Western Electric Co., has left for Europe on a two months' trip which may result in important developments in the European telephone situation. He will make an inspection of the company's European branches and factories. He will also look into the possibility of the establishment of an international telephone system for Europe. Frank Gill, president of the Institution of Electrical Engineers of London, advocates such a system operated by an international commission to control long distance lines.

ACCIDENT PREVENTION HINT

Some Fords and some mules are self-starters. If they are not, watch out for the kick.

One Reason Why Service Is Poor



We will give you one guess as to whether service is poor or good in the Exchange where these pictures were taken

Telephone at Victoria, Brazil, Controlled by American

Operation of the public utilities of Victoria, capital of the State of Espirito Santo, Brazil, has been turned over by lease to the Servicos Reunidos de Victoria, S. A., a company capitalized at 1,000,000 milreis and controlled and managed by George A. Hodge, an American. The lease runs for forty years, with the company's option of renewal for another forty, and covers the operation of an hydro-electric power station, the furnishing of electric light and power, operation of the tramways, telephone system, water supply and sewage system, also several launches used as ferries.

Determining Phone Rates

Further Light on a Study Which Created Much Discussion at the National Telephone Convention—Factors Which Justify Deviations — Bases for Bonuses and Penalties

By C. A. Wright and D. B. Judd

Various telephone men have suggested that rates for telephone service should be standardized, the number of stations served in a community determining the rate for the various classes of service, and that unusual conditions or service be recognized by bonuses or penalties applied to individual cases. The population of the exchange area and the calling rate might be suggested also as fundamental bases for standardization. The fundamental basis for the standardization of telephone rates should represent natural conditions which confront the telephone companies and over which they have no control. It would be independent of the effectiveness of the management of the companies. The calling rates, whether maximum or average calling rates are considered, are not independent of the effectiveness of management, but are affected by it, and they are therefore not a satisfactory basis of comparison. The population of the exchange areas represents more nearly than any other single condition the problem presented to the telephone companies, but it is sometimes not easily available, especially in the cases of small towns where a large proportion of the subscribers live in rural districts. The number of stations served in an exchange area while not quite as satisfactory in this respect as total population has the great advantage of being always available, and it is probably the most desirable basis of comparison.

Effects of Bargaining and Competition

In some communities the telephone company may be able, by ability to bargain which is above the average, to gain the advantage in fixing the rates, while the community may gain the advantage in other cases. Monopoly or unfair influence, the disposition to profiteer, the value of the telephone to the subscribers, and the ability of the subscribers to pay fair rates all affect the rates, sometimes to the advantage of the company and sometimes to its disadvantage. If a sufficient number of cases are considered the advantage will be on the side of the telephone company as often as it is against it, and the average curve may be assumed to be independent of inequalities in bargaining power. In towns, where there are competing telephone companies the bargaining power of the companies is greatly decreased and the rates are consequently low. In such cases, the value of the service is decreased, and the communities probably pay rates in proportion to the value of the service they receive.

Closely associated with bargaining power are the effects of the character of the community and the grade of service it wants and is willing to buy. In some cases communities of the same size may have one an industrial population and the other a farming population, but this is not usual. Generally these differences correspond to differences in the sizes of communities. Usually the grade and amount of service demanded varies regularly with the sizes of communities, very rapidly for smaller communities, and more gradually for the large communities. In so far as such conditions are concerned, then, it may be assumed that the average rate is the fair rate for communities of the size under consideration.

Factors Which Justify Deviation

If the plant and traffic conditions with which a telephone company has to contend and over which it has no control are such as to make the investment and production costs, the sum of which are the total cost of producing the service, higher or lower than the average, the telephone rates should be correspondingly higher or lower than the average. If also the service is very good or very poor, the compensation of the telephone company for that service should be correspondingly high or low. Bonuses or penalties should be applied to the average rates to give rates which are just to individual telephone companies and the communities they serve. These bonuses or penalties applied inversely to the just rates of individual telephone companies should give the average rates. *The value of this rate standardization plan depends upon the possibility of obtaining bonuses and penalties which may be weighted properly and fairly, and which may be evaluated for individual cases without the expense and inconvenience of the present method of evaluating telephone plants, and which will take account of abnormal plant and service conditions. If incidentally these bonuses and penalties are closely associated with the elements of service given the subscribers and emphasize good service, the value of the rate standardization plan in encouraging good service will be great.*

Bases for Bonuses and Penalties

Unusually high plant and operating costs, which are not the fault of the management, peculiar characteristics of the community which make it difficult to give service, and other natural obstacles with which a telephone company has to contend are one natural basis for bonuses, or penalties. The service given is the other basis which should be recognized. Good or poor service may be recognized by analyzing service, weighting its various elements more or less arbitrarily according to the judgment of representatives of the telephone companies and the public, and comparing the elements of service of the individual companies with those weighted elements; or by the results of good or poor service as shown by the telephone development in a community, and the average use made of the telephone by the subscribers. The latter basis for judging service is probably the best. An evaluation of service by any analysis of service from its elements would set up a standard which would not develop as service conditions change. It would be too rigid and inelastic. The various elements of service would have to be arbitrarily weighted by representatives of the various interests concerned. Such a method would afford much opportunity for difference of opinion both in preparing a standard table of weighted elements of service, and in applying this table to individual cases. It may be seen that the attempted use of such a method of recognizing the degree of excellence of service would result in much friction. Table herewith shows the various elements of service which would have to be considered. A discussion of these elements of "Telephone Service" may be found in Circular No. 9, Engineering Experiment Station, Ohio State University.

It may be contended that assigning bonuses and penalties on the basis of the above elements of service would be more direct and for that reason more satisfactory, and attention might be called to cases which will undoubtedly

Table I. Analysis of Telephone Service

- **ADEQUATE TELEPHONE PLANT**
  - Good Telephone Transmission
    - Loudness
    - Quality
    - Freedom from interference
    - Education of public in regard to necessity for good equipment
  - Adequate Facilities
  - Simplicity of Substation Equipment
  - Reliability of Equipment
  - Safety
  - Permanence
- **EFFECTIVE TELEPHONE OPERATION**
  - Accuracy
  - Continuity of Service and Reliability of Operation
  - Speed
  - Assurance of Attention
  - Courtesy and Form
  - Secrecy
  - Service Inspection
  - Education of Public in Regard to the Use of Telephone
- **GOOD MANAGEMENT**
  - Business Methods
    - Accuracy
    - Promptness
    - Simplicity
  - Financial Policy
    - Adequate depreciation reserve
    - Adequate surplus
    - Adequate rates
    - Proper control of securities
  - Care and Training of Employees
  - Citizenship
    - Progressiveness
    - Appearance of plant
    - Regard for rights of public
    - Local interest and cooperation
  - Publicity
    - Condition of plant
    - Methods of operation
    - Service objectives and results obtained
    - Reasons for rates

occur in which there will be injustice done to telephone companies, as for example, those of communities where the provision of a high grade of service has not been followed by high development or a high average calling rate.

Although it might be practicable to apply bonuses or penalties based on plant and operation elements of service, the results of good management are much more intangible, and it would be difficult to weight and apply the corresponding elements of service directly. The condition of unfairness suggested is more likely to exist temporarily after the provision of the high grade service than permanently, unless the telephone company has used poor judgment in providing a better grade of service than the community desires. In such a case the telephone company would not deserve a bonus.

In justification of the use of development and average use of the telephone by subscribers, as bonus and penalty bases, it may be suggested that it makes necessary the use of only a few bases for service bonuses and penalties thereby avoiding the complicated process of weighting service which would result from assigning bonuses and penalties on the basis of service elements; also, the conditions which would warrant bonuses and penalties would be easily obtainable, and the development and average calling rate show the final result of good or poor service. *It is the result in which we are interested rather than the factors which produce the result.*

Need for Bonuses and Penalties

The necessity for bonuses or penalties for unusual plant conditions or service has been recognized to a certain extent by public utility commissions which have frequently granted rates in excess of those which are normal for communities of the size in question because of a general impression that service is unusually good, because the plant conditions encountered are unusually severe, because the plant has been maintained in exceptional condition, and in many cases because of "free service."

The Interstate Commerce Commission and various telephone statisticians in their reports have recognized the importance of pole line and wire miles, average calls, and development, although no attempt has been made to make use of them as bases for bonuses and penalties in fixing telephone rates.

Specifications for Bases for Bonuses and Penalties

The following specifications should, then, be observed in choosing bases for bonuses and penalties:

(1) The final results of good or poor telephone service, that is, the amount of service sold rather than any specific elements of service, should be used as bases for bonuses and penalties.

(2) Unusual plant conditions over which the telephone company has no control should be used as bases for bonuses and penalties.

(3) The bases for bonuses and penalties should be few in number.

(4) They should be easily determined from existing records or records which it is otherwise to the advantage of the telephone company to keep.

(5) They should be general in character, and indicative of plant and service conditions as a whole. *The choice of the bases for bonuses and penalties is altogether a matter of judgment, and can be decided only by the vote of large numbers of informed and interested parties. The four bases suggested in this bulletin are those which from this investigation seem most reasonable.*

The cost of producing telephone service in general determines the lower limit of the rates paid for service, although there will be found many cases where for a considerable time this has not been true. The upper limit is determined by the value of the service to the telephone using public. The rates obviously can not be permitted to exceed this upper limit. Attempts to charge "all the traffic will bear" generally result in rates which are greater than the traffic will bear and people will not buy the service. While the rates have too frequently been such that they would not cover the cost of service, care should be taken that they are not permitted by means of bonuses in any case to approach the upper limit, or "all the traffic will bear." In such a case the granting of rate bonuses to a telephone company might defeat its own purpose by discouraging the use of the telephone. Moderation should be observed in the application of bonuses and penalties.

Plant Cost—Difference in Central Energy and Magneto Rates

The cost of central office equipment should generally not vary greatly from the average for each group of telephone companies operating the same number of stations. If there is any difference, it would probably result from a difference in the maximum calling rate or peak load demand upon the telephone exchange. Exceptions which occur are cases where central energy and magneto exchanges serve communities of the same size. In an investigation of one large group of telephone compa-

nies it was found that the point of change on the station-rate curve from magneto to central-energy switch boards is fairly sharp and definite at 1,000 stations. If average curves are plotted separately for the magneto and central energy stations a discontinuity in the curve at the point of change may reasonably be expected. If the curves are prolonged at the point of discontinuity so that they will overlap, they might well show what additional rate a central energy exchange in a magneto group should be allowed, or what should be the decrease in the rate of a magneto exchange in a central energy group. This difference would of course be due to the difference in value of the two kinds of service as well as to the difference in cost. In the case above mentioned, the two curves were continuous, indicating that in this case there is no difference in cost and value. The same reasoning might be applied to ringing equipment, but in this case also there were no discontinuities, indicating that the differences in rates due to ringing equipment are not important.

As Regards the Area Served

There is a considerable amount of variation in the cost of outside plant, within groups of companies operating the same numbers of stations, due to area served and unusual construction difficulties. Miles of pole line per station, or number of poles per station, preferably the former, may be taken as a measure of the area served, and as a basis for a bonus or penalty. Wire miles has received consideration, but it is not a good measure of the area served by a telephone company. Area itself might be used directly, but there would be considerable difficulty in defining the area served. One or two stations in an otherwise undeveloped area might serve as an excuse on the part of a telephone company for claiming a bonus because of the large territory it serves. Miles of pole line is probably the best measure of the territory actually served by a telephone company.

In cities where a large proportion of the circuits are underground, miles of underground conduit per station modified by a factor which will properly weight it relatively to the pole line should be added to the pole line per station. As this investigation has not considered the largest communities pole line per station only has been used. Among the possible unusual construction difficulties may be mentioned the character of the ground. The cost of extending lines through a hilly and rocky country is of course greater than through a country where the ground is easily workable. It often happens that in cases where the cost of construction is greatest, the people are least able to pay adequate telephone rates, as for example, in a rocky and barren country, where it is difficult to farm successfully and difficult to construct lines.

Calling Rate Is a Factor, Also

Maximum busy hour load or maximum calling rate may also be taken as a cost bonus or penalty, independent of the average calls per station which is later suggested as a value bonus or penalty. It determines the cost of part of the central office equipment and is an indication also of the cost of operating the switchboard. An approximate measure of this factor is the maximum number of operators' positions in use, but it is not as desirable as the maximum busy hour load as determined by a peg count, because it is not independent of the efficiency of operation of the telephone plant. In the evaluation of bonuses and penalties in this report both cost and value elements are cared for by one bonus or penalty which is determined by the average calls per station. This will result in a bonus or penalty which is approximately the sum of the two bonuses or penalties obtained by considering the cost and value factors separately.

An examination of the maximum busy hour calling rates and average calling rates of a limited number of exchanges for which information in regard to maximum-busy-hour calling rates could be obtained indicates that they vary approximately in the same proportion, or, in other words, that the amplitude but not the form of the average daily traffic curve for the year varies with the community. This statement is probably more nearly correct when communities of the same size and type are compared than when the comparison is made between those of different sizes and types. In the examination referred to above, all of the communities were of about the same type, served by from 1,000 to 3,000 stations. If maximum busy-hour load were used as a basis for a bonus or penalty it should not be difficult for public utility commissions to induce the telephone companies to inaugurate the use of peg counts in cases where it had not already been done.

The busy hour calling rate and the average calling rate may both be affected by conditions such as the industrial character of the community or the proportion of foreign born persons in the population and the nationality of the foreign born population. For example, the use of the telephone by a French quarter of a city is likely to be much greater than its use by a Scandinavian quarter of the same size.

Plant Condition Is Another Item

A valuable element of telephone service is the assurance to the subscriber that the service will be continuous. The condition of the telephone plant in a large measure determines the extent of this assurance. It may in many cases be possible to estimate the condition of the plant from a statement of its age, and statements of depreciation reserve, and issues of stock and bonds. Accrued depreciation may be the basis for a penalty or bonus.

If a plant is over-built to a reasonable extent, it would probably be just to allow a bonus. A plant should be over-built enough to make it possible to furnish service to new subscribers without delay. Records of applications and time necessary to furnish service might be used to advantage as an indication of the condition of the plant in this respect.

A reasonably over-built condition is very desirable in the case of telephone companies. If there is an unusual demand for street railway transportation it may be met by crowding passengers into the cars, and the additional equipment necessary may be provided after the increased demand has developed. New users of electric light and power, gas, and water service may generally obtain connection to already existing supply circuits or mains, and additional equipment may be provided in the central station or gas or water plant when opportunity permits, but the additional plant does not generally have to be made before the new users are supplied with service.

Each telephone subscriber or in the case of party lines service each small group of subscribers, requires a circuit to the central office for his sole use. Such a circuit must be available before a new subscriber can be supplied with service. During the extreme conditions which have existed in the past few years many telephone companies have attempted to meet the situation by making party lines of direct lines, or in some cases even by making ground return circuits of metallic circuits, but the results have been most unsatisfactory to both telephone companies and subscribers. In order to supply service promptly to new subscribers, a telephone plant must be over-built. An over-built condition may be regarded as the opposite of a depreciated condition.

In this investigation bonuses or penalties have not been allowed for plant condition or facilities. They may be considered to be included in development of bonuses and penalties. People will not subscribe to telephone service if they feel that it will deteriorate because the plant is not maintained, and they cannot subscribe to it unless there are adequate plant facilities. However, these elements of service are important and it may be possible that they should

be the basis for a separate bonus or penalty.

Telephone Service—Analysis of Development

The average excellence of telephone service increases as the station rate curve increases, but in each group of telephone exchanges serving the same number of stations there are individual exchanges to which bonuses or penalties are due because of the quality of their service.

The degree to which people buy telephone service and the degree to which they use it are approximate measures of the excellence of the service. The development in stations per thousand people shows not only how aggressive the management of a company has been in selling telephone service, but how good service is maintained, as the better the service, the easier it is to sell. It may be difficult in the cases of small communities to ascertain how great a rural population might possibly be served by a telephone company. While not entirely satisfactory, the development within the town or city might be used, as a measure of the total development. In the cases of the larger cities, the proportion of subscribers who are rural subscribers is small and will not affect the development to a great extent.

It is much less difficult to obtain the increase in stations in a community where the development is not high, than to obtain the additional stations in an already well developed territory. Frequently the last subscribers obtained are the hardest to obtain.

It might be suggested that increasing the development is the same, as far as rates are concerned, as putting the exchange in a higher class, on the station-rate curve, but this is not true. The value element of the service indicated by the development for which a bonus or a penalty is given does not result from the number of stations served, which is taken account of by the position of the exchange on the station-rate curve. It results from the higher grade of service produced. Because the service in itself is better, and because the subscriber may, if he desires, obtain connection with a greater number of telephones, the telephone company in question can sell more telephone service, but the latter element of value is otherwise recognized and the bonus should be applied only for the good service.

If development were used as a basis for a bonus or penalty it would probably not be difficult for a public utility commission to obtain the population, the corresponding number of stations, and the development of each exchange area in its state.

The provision of "free service" lines to neighboring towns has been recognized as having value to the subscribers, and public utility commissions have allowed increased rates because of free service. Free service has the same kind of value as increased development, but the value per given percentage of increase in subscribers with whom it is possible to get connection is not as great as in the case of an increase in development. There is not as free interchange of service over the free service lines as in the case of interoffice trunks in an urban exchange area, because it is less convenient to use the facilities provided for free service than to use those provided for normal local service and because there is less community interest among subscribers in neighboring communities than among those in the same community.

When there are two competing telephone exchanges in a community the rates tend to decrease because of the competition, as mentioned above, and incidentally the service is worth much less because of the competition. If rates were determined by modifying the average rate in accordance with development, the development of each exchange might be considered as either the total stations of the community divided by the total population (expressed in thousands) of that community, or the stations of that exchange divided by the total population of the community. In the latter case, which is probably the more just, the rates will be low because the development is low, and the rate of the new exchange will be the lower of the two if it has less stations than the other, and in the other case the development and therefore the rates will be high, as on account of the competition the development will be high.

Calling Rate Busy Hour a Measure

Not only may the excellence of service be measured by the proportion of total population who buy telephone service, but also by the extent to which each subscriber uses his telephone. The number of calls per subscriber may be computed from the estimated number of calls per year, or if the distribution of calls throughout the day and year is regular and known, from the busy hour calling rate. A rough measure of the busy hour calling rate is the number of operators' positions occupied, but, as suggested above, this is not entirely satisfactory because it is not independent of the efficiency of the operating force or management, as is the calling rate. Even if the calling rate is low, the number of operators' positions occupied may be high because of inefficiency of operators or of the switchboard in use.

The busy hour calling rate is more nearly a measure of the demand on the telephone exchange because it is approximately proportional to positions of the central office equipment and the number of operators employed, while an average calling rate per station is not so good a measure of the demand on the exchange, but is probably a better measure of the satisfaction given the subscribers by the service. Estimates of the average number of calls per month or per year are generally available, while very few of the smaller telephone companies have ever taken peg counts, which would show their busy hour calling rates. However, if required by commissions, busy hour calling rates could probably be obtained without great difficulty, and would generally be a more satisfactory means of measuring the use of the telephone by the subscriber than the estimates of numbers of calls.

PLATTE COUNTY SELLS

Lincoln, Neb., Telephone Magnates Buy 2,000 Station Independent

Columbus, Neb.—Officials of the Lincoln Telephone and Telegraph Co., Frank H. Woods, R. E. Mattison, W. E. Bell and W. L. Lemon have bought two-thirds of the Platte County Independent Telephone Co. stock from the controlling factors, who are C. J. Garlow, president; R. Y. Lisco, vice-president; G. W. Phillips, secretary-treasurer, and Charles Louis and Fred Kluck.

A new official list has been named, with R. E. Mattison as president; W. E. Bell, vice-president; W. L. Lemon, secretary and treasurer, and Mr. Woods on the board, along with Mr. Phillips.

The purchase was made as individuals and not as representatives of the telephone company, and that no plans were under consideration for joining the purchase with the operation of the Lincoln company it is stated.

The company was organized in 1904 by Iowa men, and in 1909 Mr. Garlow and his associates purchased it. Later the Bell company put in a competing exchange, but lost money from the start. Four years ago the Bell sold its exchange property to the Platte county company, but because of the city's business importance and its being a switching center, have kept a toll-board there.

OPINIONS AND COMMENTS

RADIO REGULATION

When the White Bill, designed to bring order into the radio field, failed to pass the Senate it seemed that we were doomed to have the present chaotic condition continued at least until another Congress could meet. However, if the recommendations made by the second National Radio Conference can be put into effect by the Secretary of Commerce conditions should be much improved.

In brief, the conference recommended the distribution of broadcasting stations over a considerable band of wave lengths instead of concentrating them on two or three waves. At the same time, as far as possible other stations will be removed from that band. This alone will result in great improvement if the Department of Commerce finds that it has authority to make such a change.

One recommendation of interest to telephone men who have been considering rebroadcasting is that which would confine rebroadcasting to broadcasting wave lengths and would permit it only with the authorization of the original broadcasting station and the Department of Commerce. The information available does not indicate whether this would cover the rebroadcasting over wire lines by line radio.

This is a matter which will undoubtedly require attention in the near future. It would seem that line radio should not be subject to radio laws as long as the energy is confined to the wires, but if any of the energy escapes and causes interference with radio stations or even with wire communication lines, some form of regulation will certainly be needed.

Money is the root of all good, according to state meetings.

CONVENTION DATES

The U. S. Independent Telephone Association is endeavoring to work out an arrangement with the various state associations which not only will obviate any conflicts in the dates of the various state conventions, but will provide that Northern conventions be held in the Summer time and Southern conventions in the Winter. There are 23 different state conventions. Accordingly it has become very difficult for manufacturers' representatives and others to get to all of these meetings. Perhaps the chief objection entered thus far against the proposed plan is due to the legislatures meeting, every other year, during the Winter. Some telephone men seem to think they should meet and discuss legislation affecting telephone companies while the legislatures are in session. This objection may be met by appointing a legislative committee from each state association who will take up with their legislators any proposed measures affecting the industry.

TELEPHONE ENGINEER

Vol. 27 April
No. 4 1923

Entered as second-class matter, June 6, 1922, at the post office at Chicago, Ill., under the act of March 3, 1879.

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SUBSCRIPTIONS

The subscription price of TELEPHONE ENGINEER is $2 a year in the United States, Cuba and Mexico; in Canada it is $3; in all other countries $4. Single copies, U. S. A., 20 cents.

ADVERTISING

TELEPHONE ENGINEER is issued the 15th of each month. Copy can be accepted as late as the 8th of the month preceding date of publication. Where proof must be seen, allow ample time for transmission in the mails. Display Advertising — Rates on application. Classified Advertising—"Wants," "For Sales," etc.—$3 an inch, or 6 cents a word per insertion.

BUY SUPPLIES NOW

The general improvement in business conditions has definitely turned the trend of prices upward. Copper which has been at a very low price for a long time due to the large accumulated stocks has now taken an upward turn and most other items that go into the make-up of the telephone plant are showing signs of following.

A successful trader once attributed his success to the fact that he did not wait for the extreme of low prices before buying and that he sold before the peak was reached. No doubt there have been many telephone companies which have not followed this advice but have been holding off in their buying expecting even lower prices.

The telephone company that has made this mistake may yet take advantage of price conditions in most lines but there is a general feeling in the trade that prices are due for an advance in many lines and if orders are delayed much longer the opportunity will have passed and such companies will again be forced to do their buying at higher price levels that accompany improving economic conditions.

"LET'S GET TOGETHER"

The spirit of "Let's get together and reason it out" which was emphasized in the recent address of William H. O'Brien of the Telephone division of the Massachusetts Public Utilities Commission is one worthy of consideration. The policy of friendly cooperation between a regulatory body and a public utility as outlined in Mr. O'Brien's address must certainly result in improvement of service to the public and must, just as certainly, minimize many of the difficulties that a utility company finds.

MANAGERS WE'VE KNOWN

A telephone manager of our acquaintance was once appointed as a "viewer" on a proposed paved highway in the county in which his property is located. His duty was to inspect the proposed highway and, in company with other "viewers," to determine the necessity and the nature of the proposed improvement.

In the process, a discussion arose as to whether a twelve foot or a sixteen foot pavement should be laid and this telephone man, after a consideration of the volume of traffic on the highway, reached the conclusion that the sixteen foot highway was required.

He expressed this opinion to his confreres and one of them said, "We did not expect you to agree to the wider road. Did you notice that you will have to move about a half mile of pole line?" This manager replied, "I am serving now as a citizen of this county and as a user of this highway and that is the viewpoint I must take. If it conflicts with my interest in the telephone business, the latter must take a second place."

Not many men, perhaps, would place public interest before private interest in a case of this kind where a decision in either direction might be defended. It would have been easy to defend the selection of the narrower roadway and, possibly, make a saving of considerable expense, but here was a man who preferred to follow his conscience rather than his pocketbook.

In this particular case, however, the pocketbook could scarcely be said to have suffered for when this manager went before his Public Service Commission for an increase in rates he was able to show resolutions from practically every civic body, and letters from a considerable percentage of his subscribers advocating the increase. The reason he was able to do this was because he had built up the confidence of his public through years of fair dealing and his subscribers were willing to pay any rate that the Public Service Commission would grant because they believed that he would not ask for a rate that was unfair to them.

REGROUPING THE PARTY LINES

As the spring construction program progresses and changes in the arrangement of lines becomes necessary, the old difficulty with changed numbers on party lines is bound to reappear. It is made necessary, not only by new construction but frequently by the necessity of providing an economical arrangement of subscribers on existing plant.

A subscriber who has lived at one address and who has had one telephone number for several years comes to regard himself as having property rights in that telephone number. This happens in spite of telephone directory notices to the contrary. He is naturally not very well pleased when he happens to call his home on some afternoon and when his call is questioned, is informed that his telephone number is now Blank 4411Z, or some equally strange number. It is worse still if a voice which he does not recognize answers and informs him that his old number is the new number of a perfectly strange family.

Every telephone company operating jack-per-line party lines must face this difficulty and must, inevitably, meet the objections of subscribers when numbers are changed. However, there are ways in which the difficulty may be reduced. Advance notice to the subscriber, with an explanation of the necessity, will do much toward retaining his good will. Care in giving notice to the traffic department as soon as a change is made and an operative system of handling calls for changed numbers will prevent a large number of false calls.

Some subscribers seem to be the victims of circumstances and are subjected to a change of number every year or so, while others are not disturbed over a period of several years. A little care in distributing the changes so that any one subscriber does not get too many of them will also help. Finally, the most opportune time for making such changes is just before a new directory is to be issued, so that as many of the changes as possible may appear in the directory when it is issued.

THE LOCAL BUDGET

One of the recognized difficulties of the functional form of organization is the difficulty of securing proper co-operation between the various functional departments. In the functional form of organization the accomplishment is measured in terms of departmental standards rather than in terms of the standard of the general service.

In discussing this matter at a manager's meeting reported in Telephone Topics, General Commercial Superintendent Whitney, of the New England Telephone and Telegraph Co., pointed out the necessity of a non-functional co-ordinating objective that is common to all departments in a given area. Such an objective is a local area budget and balance sheet which will show, not only the accomplishment of each department but the accomplishment of the area as a whole.

This local balance sheet furnishes a powerful tool for compelling and measuring co-ordination of local departments and make the heads of functional departments the managers of a business as well as technical specialists in their departments. Such a plan should relieve the general officers of much of their responsibility of co-ordination and should lead to the developing of a better and more business like service in the area. It should also make for broader development of the individuals of the supervisory forces and for greater interest in their work.

Taking the "con" out of conventions was an achievement of state meeting program makers this year.

Spring Construction Plans

Reports from the Field Indicate That an Extra Busy Season May Be Expected — Some More News Letters Received from Our Readers Since Last Issue

It looks like a big year.

Reports keep coming in from our readers about their plans for the season. Several pages of these reports were printed last issue, showing unusual activity and indicating an early start.

A better feeling throughout the agricultural population, due to better prices, has been reflected in the increased volume of work planned by rural telephone companies. Improved conditions in the world of commerce and finance also are helping the larger telephone companies. All told, 1923 should prove one of the banner years of the telephone business.

Field reports, received since our March issue was printed, are given herewith:

Citizens Telephone Co., Paris, Ark., is installing some underground cable this season. Conrad Elsken is president and general manager.

McRae-Helena Telephone Co., McRae, Ga., will build twelve miles of copper toll line this season. W. D. Horton is secretary, treasurer and manager.

Effingham County Telephone Co., Altamont, Ill., will do considerable cable and pole replacement this season. J. A. Stice is general manager and Earl F. Stice purchasing agent and plant superintendent.

Joy Telephone Co., Joy, Ill., will rebuild part of its country lines this season. W. V. Holmes is manager.

Stronghurst Telephone Co., Stronghurst, Ill., intends to build additional rural lines this summer. G. C. Rehling is secretary and general manager.

Southern Indiana Telephone Co., Aurora, Ind., will put in a new switchboard soon to meet increased growth of patronage. This company's territory was visited by a hurricane recently, but its lines were so well built that little damage was done. E. W. Swarthout is president of the company, W. P. Swarthout, secretary, and C. R. Abdon, general manager.

Farmers' Co-operative Telephone Co., general office at Burket, Ind., now has 1,348 stations at Claypool, Silver Lake, Packerton, Burket, Mentone and Big Foot. Its lines extend into four counties: Kosciusko, Wabash, Fulton and Marshal. This company, which is capitalized at $60,000, formerly was known as the Claypool Telephone Co. It took over the Farmers' Mutual Telephone Co., of Silver Lake, in 1920. George M. Alexander is general manager.

Mutual Telephone Co., Olds, Ia., will install considerable cable this summer. George G. Larsen is manager.

Farmers' Mutual Telephone Co., Stanton, Ia., will install 160 rods of cable this season. John S. Olander is manager.

Tracy Telephone Co., Tracy, Ia., is in the market for poles. W. G. Maddy is president and M. Miller secretary.

United Telephone Co., of Abilene, Kan., recently completed a new exchange building at Marysville, Kan., where F. M. Sparks is manager. New plant and equipment also has been installed, making the whole system up-to-date.

New Sharon & Norridgewock Telephone Co., Norridgewock, Me., will do considerable rebuilding of lines this season. Geo. J. Chandler is manager.

Pullman Telephone Co., Edwardsburg, Mich., will completely rebuild its system this season. E. F. Harsh is general manager.

Rollog Telephone Co., Hawley, Minn., will undertake some forty miles of reconstruction work this season. A. L. Ruud is manager.

El Dorado Springs Telephone Co., El Dorado Springs, Mo., will install a new switchboard and considerable cable this season. H. W. Schwalm is owner.

Mt. Vernon Telephone Co., Mt. Vernon, Mo., will erect a new exchange building this season. Suggestions are requested from telephone men as to plans that might be helpful in designing and equipping the new structure. J. N. B. Shelton is manager.

New Jersey Telephone Co., Lebanon, N. J., plans for general improvements this year, according to E. W. Sutton, manager.

Schenectady, Delauson & Esperance Telephone Co., of Esperance, N. Y., will make a number of extensions this season. A. J. McIntosh is manager and F. R. Montanye superintendent.

Annual statement of the Black River Telephone Co., Lowville, N. Y., shows 5,219 stations of its own in operation, beside 442 stations owned by others. The net operating profit for the year was $20,455.63, out of which $8,450 in dividends was paid, leaving $12,005.63 net profit to surplus. J. J. Domser is general manager.

Schoharie Telephone Co., Tannersville, N. Y., will install 5,000 feet of cable this summer. Renwick Dibbell is manager.

Heins Telephone Co., Clinton, N. C., will change to common battery soon. E. C. Heins, Jr., is manager.

Mercer County Mutual Telephone Co., Celina, O., will erect about ten miles of toll line this summer. E. G. Barker, R. D. 6, Celina, O., is president and manager.

Carbon Telephone Co., Lansford, Pa., writes us new C. O. planned. S. H. Mounce is manager.

Missouri Union Telephone Co., Clinton, Mo., is planning to add rural lines soon.

Blairsville Telephone Co., Blairsville, Pa., will change to a common battery system and erect a new office building soon.

Winnsboro (S. C.) Telephone Exchange will install a new switchboard, 50 telephones and 6,000 feet of load cable this summer. L. E. Crossland is manager and engineer.

Peoples Telephone Co., Scott's Hill, Tenn., will do considerable general repair work this summer and build some new lines. Supplies wanted include wire, brackets, pins, cross-arms, insulators, etc. W. A. Austin is manager.

Madison Telephone Co., Shelby, Va., is in the market for telephones. G. L. Gibb is manager.

Inter-Island Telephone Co., of Friday Harbor, Wash., will rebuild most of its outside plant this year, probably relaying two and one-fourth miles of cable. Quotations are requested on that amount of 2-conductor submarine cable. R. L. Pickering, Port Stanley, Wash., is distribution plant manager.

Tri-County Telephone Co., Aniwa, Wis., will build about five miles of new line and will install a number of new telephones. Floyd J. Peterson is manager.

Alliance Telephone Co., of Minong, Wis., will build 18 miles of new line and install 50 new telephones. P. M. Olson, president, 317 Third street, Spooner, Wis., advises that they are in the market for those 50 instruments, 15 miles of No. 12 B. B. wire, 100 lightning arresters and various other accessories.

Plans Reported by Canadian Companies

Revelstoke, Trout Lake & Big Bend Telephone Co., of Revelstoke, B. C., Can., will renew 100 poles this season and replace six wood terminals with steel ones. The company, of which W. Cowan is president and manager, is in the market for the six steel terminals and 3,000 feet of 25-pair cable.

Blissville & Petersville Telephone Co., of Hoyt Station, N. B., Can., will build a new line to carry twelve telephones this season. H. H. Smith is manager.

Sandwich West Telephone Co., of Loiselleville, Ont., Can., will extend its lines about three miles this spring and will need poles and wire accordingly. Wm. Pajot is manager.

The Canadian National Telegraphs, of Toronto, Ont., Can., has just completed over 200 miles of dispatching telephone system, with forty stations.

Farmers Telephone Co., Howick Station, P. Q., Can., will build thirty miles of new lines this summer to care for additional subscribers. W. F. Welch, secretary, treasurer and manager, writes us that most of the necessary supplies already have been purchased.

Avonlea Rural Telephone Co., Avonlea, Sask., Can., is in need of batteries and sundry supplies for its season's repair work. C. T. Babcock is manager.

Saskatchewan Government Telephone Department, Regina, Sask., Can., will install a 100-line automatic system at the provincial hospital there. A. H. Lyddall is inspector in charge.

Unity Rural Telephone Co., Unity, Sask., Can., will build six new rural circuits this season. Thos. Frost is secretary-treasurer.

India Company Wants Telephone Business

Chicago, Ill.—Cama, Norton & Co., 11 Elphinstone Circle, Bombay, India, ask TELEPHONE ENGINEER to say that India in general, and Bombay in particular, have large openings for engineering enterprises and that their firm invites catalogs and correspondence.

Poles Roll from Car, Whip Down Right-of-Way Line

Kendallville, Ind.—Slipping of a load binder on a load of poles being hauled by the New York Central near here, scattered the cargo of poles along the right-of-way. One of the flying poles knocked down several poles belonging to the local telephone company and caused interruption of service along several important rural leads.

Wray Says Indiana Bell Costs Justified by Reserves

Indianapolis, Ind.—Testifying for the Indiana Bell Telephone Co. in the commission's rate hearing here, J. G. Wray stated that the Bell book cost is higher than that of Indiana Independent companies' book costs per station because the Bell has spare facilities which the Independents lack. He added that his experience with the Bell prior to 1912 led him to believe that Bell book costs are understated.

Charlestown, W. Va.—Capital stock of the Chesapeake and Potomac Telephone Co. of West Virginia, has been increased from $7,500,000 to $12,000,000.

Cleveland, O.—Ohio Bell Telephone Co. is to spend $10,700,000 in unification work this year.

ORDER IN RADIO WORLD

Radio Conference Submits Recommendation Designed to End Present Chaos

Washington, D. C.—The Second National Radio Conference which met in Washington on March 24th, has announced its recommendations to the Secretary of Commerce. The conference considered the matter of interference between broadcasters and the consequent difficulty experienced by listeners. It is expected that the Department of Commerce, acting under its present authority, will be able to establish and enforce new regulations which will bring order into the radio world.

Boiled down, the important recommendations of the conference are as follows: A new field for broadcasting extending from 222 to 545 meters can be created. The higher powered stations will use wave lengths between 288 meters and 545 meters, while lower powered stations will use 222 to 286 meters. This will enable higher powered stations located in 50 localities to be within reach of every listener.

Amateurs will be allotted a band extending from 150 to 222 meters. The band above 200 meters will be reserved for high grade, continuous wave telegraph transmitting stations operating under special license. Ships using 450 meters are to keep silent from 7 to 11 p. m. and are to be readjusted to work on 600 meters as soon as possible.

Provision is made for a new field of ship-to-shore telephone service on wave lengths far above the broadcasting wave lengths. It is also recommended that simultaneous rebroadcasting be permitted only on broadcasting wave lengths and with the authorization of the original broadcaster and the Department of Commerce.

The recommendations are based upon a plan submitted by the radio inspectors of the Department of Commerce with modifications submitted by a number of interested groups. It was the unanimous opinion that the department has authority under the present law to regulate hours and wave lengths of operation of stations and to revoke or withhold licenses when such action is necessary to prevent interference detrimental to public good.

St. Paul, Minn.—State taxes on the earnings of the thousand and more Minnesota telephone companies for 1922, according to the state treasurer, are $597,953.11.

Harrisburg, Pa.—Approximately $2,500,000 will be spent for land, building, and equipment by the Bell Telephone Co. of Pennsylvania in its new establishment here.

More About Buried Cable

Ohio Company Finds Buried Cable Satisfactory If Conditions Are Favorable — Lack of Flexibility One of the Important Drawbacks That Calls for Consideration in Growing Cities

By C. W. Kugelman
(Plant Superintendent Portsmouth, (O.) Telephone Co.)

In this day of high prices we are often prone to want to do things as cheaply as possible and we may sometimes overstep the bounds of good judgment. One of these places is in the planning of the cable plant. To my mind managers and owners of telephone properties should go slow and figure on the extremes when estimating cable jobs. Many times conditions will change over night, particularly in a community which is accessible to big business.

In the city where the writer lives, a single death has changed the entire layout of a section of cable distribution. The paving of a street has made city lots of a farm. Hills which no one, a few years ago, thought would be occupied by houses are being leveled off and fills are being made to bring low places and gullies into condition for buildings. Along navigable streams and transcontinental railroads, villages are growing into cities almost over night and telephone operators are hard put to meet the new conditions and the rush of new orders for service.

The "Ifs" of Buried Cable

A few years ago we decided to try out, what to us was an experiment, the burying of cable. As far as the workability of cable installed in that manner is concerned, it is good and I believe as practical as any method if—that is where the rub comes in—we reasonably know the size we bury will take care of the business for a period of, say, 10 years; if soil conditions are right; if alleys and streets will not be torn up by the installing of sewer, water and gas lines; if trees planted inside of curbings and parkways will not extend their roots and crush or break the cable or force it into places where we do not want it; if streets or alleys are likely to be paved or otherwise improved; if numerous other things that we cannot now call to mind may come up or down and put a crimp in our plans. From a life or workable standpoint we would say that with good soil conditions and freedom from mechanical injury there is no reason why buried cable should not last as long as cable put down in conduit.

Suspicious Soil Should Be Analyzed

Right here we believe is the place to state that any one who is contemplating burying any great amount of cable, and who is at all suspicious of the soil in which it is to be laid, should send several samples of dirt taken from different places along the route to the chemistry department of the state university or to some one who is capable of making a thorough test to find out if the dirt contains anything detrimental to lead pipe. Not many of us have the education which will permit our making the proper analysis of soils.

We know that plumbers and others use lead pipe because of its resistance to deterioration. If there is anything that might injure the pipe, thereby causing leak, the trouble usually shows up in a hurry and is generally easily remedied. With a cable it is different; the leak may not show up for some time and, as a rule, when it does the weather will be against us. Wet cables do not usually show up in dry weather.

A Case of Trouble After Changes

We have in mind a case of trouble which showed up a few days ago. More than three years ago we buried a 50 pair cable along the edge of a brick highway leading from the city and thought we were fixed for some time in that locality. Increased traffic and extension of the corporation limits of that city called for the widening of the street, thereby forcing us to dig a trench the full length of the buried cable, a distance of 4,000 feet, and place in it a conduit lead. Two to five fibre ducts were put down in concrete base. The two bottom ducts were spaced three inches apart, the former buried cable placed between them and covered with a seven-eighths by six-inch pine plank. The conduits were then covered with three inches of concrete to protect them as far as possible from mechanical injury. Allow me to say right here that nothing short of bank vault steel is positive protection against the average gang of ditch diggers. I actually believe some of them would try to pick and shovel their way through the steel doors of the largest bank in America if the boss did not tell them it was too hard to cut. By the way, some bosses are as bad as the laborers. "Get a bar and sledge boys, let's see what it is." They generally find out—to our sorrow.

General Condition Found Excellent

It is no small job to dig out 4,000 feet of buried cable without cutting it. As this cable had been covered with a two by six pine plank, we had good luck and got by with less than six cuts in the entire distance. Each section was inspected before being covered and we thought every break had been found. The work was finished last August. The heavy rains of the past two months filled a manhole and caused water to back up in the duct. Four pairs showed bad recently, but cleared up before we coud get an accurate test. Later they began coming in again and a test showed the trouble to be near that particular manhole. As the distance to the next hole was short, a new piece of cable was pulled in and the piece showing trouble pulled out. Upon examination the cable showed a very slight cut, just large enough to let in a slight amount of moisture. Had it been possible to have a dry well or drain in the manhole, that piece of cable would likely never have gone bad. As far as the condition of the buried cable is concerned it was as good as the day it was made. Some of the boards were badly rotted, but no bad effect on the cable was caused.

Another cable which was dug out and placed in duct for several hundred feet was found to be in perfect condition. This cable was buried in 1917, with no protection and, aside from twenty feet which went bad, after three years, in very old ashes, it bids fair to work for many years. At the time this cable was buried we thought the ashes were too old to cause trouble, as the alley had been filled many years ago. We know better now and take no chances. The twenty feet were replaced in conduit.

So far, we have never had a case of trouble in buried cable, due to electrolysis. We have had some in cable in conduit where water got into the ducts. One cable had to be taken out of the ducts and placed aerial, as it

was impossible to keep water out of the ducts and manholes. We have found heavy plank to be very little protection against mechanical trouble and unless heavily impregnated with creosote or some other preservative are practically valueless.

Unforeseen Conditions Change Cable Requirements

The reason for digging out the cable mentioned above and placing it in duct was referred to at the beginning of this article. Death removed an old lady who owned quite a large tract of land which she would not sell. The property next to hers was owned by members of a wealthy family who did not want to cut their lawns and fields into building lots. We, therefore, concluded that it would be a great many years before we would need much cable in that vicinity and decided to replace old aerial cable with buried cable. We did not make a mistake, because at that time cable and labor were much cheaper than now. These properties have now passed out of the hands of heirs into the hands of real estate dealers and will soon be filled with many residences needing telephone service.

The paving of streets will raise taxes and owners of large plots of ground, unless wealthy, will be forced to sell the ground to real estate dealers or to parcel the land themselves into building lots. Thus an area that looked like a good bet for buried cable will become a small city, necessitating the building of conduit and manholes to care properly for future growth. It is not necessary to build manholes when using one or two duct leads in built up parts of town. Laterals can be run up and down the poles and either upright splices or junction cans installed. For cables not exceeding twenty-five pairs a combination junction and terminal can be used very nicely.

In our community the ground does not freeze deep, so it is not necessary to place cables very far under the surface. Should any changes be necessary in the cable at the butt of a terminal pole or if more cable is to be pulled in where two ducts are used, only a small hole has to be dug, the splice or change made, opening covered with concrete and we are through at a very little expense. Of course, on main conduit leads this scheme would not be good.

A Dead Village Comes to Life

In a small village near our main exchange, we decided to bury a piece of 25 pair cable for a distance of 2,000 feet. There were no paved streets or other improvements worth mentioning and it did not look as if there ever would be. Later some of the city dads decided that the town should do some improving also. Their first improvement was to concrete the street along which we had our buried cable. Luck was with us, however, as the paving was only twenty feet wide, so we get at most of the cable if necessary.

As the village is near a railroad terminal and the county roads are slated for improvement some of the business men decided to build a few houses. One of the finest race courses on the grand circuit is under the course of construction not far from the town. The town that was apparently dead a few months ago is now very much alive and our little 25 pair cable will soon need company.

Some Suggestions in Planning Cables

This incident is mentioned as a follow up of some of the "ifs" in an earlier paragraph. Before burying cable, study your plan from every angle, figure the size you think is needed, add 25 or 50 more pairs, then wait six months and see what happens before you do the work. You may be glad you waited. Get acquainted with your real estate dealers, land owners and manufacturers; find out, if possible, what their plans are. Study your town, go over it often. Every time you do you will see something new or something that could be made better as regards the telephone plant.

This article was not written to discourage the use of buried cable. We have quite a large amount which is giving satisfactory service and is ample to care for future growth. We will probably put down many more runs. But, as was stated before, we wish to be as sure as possible that the work done will be satisfactory in every way.

Telephones in Texas Show Rapid Increase

Dallas, Tex.—Southwestern Bell engineers state that Dallas, San Antonio, Houston and Fort Worth showed a 24,000 increase in population, and a 12,000 increase in telephones during 1922. The 1923 figures will show the greatest yearly gain in Texas telephone history, the report says.

A Good Cable But Our Figures Were High

On page 16 of our issue for March, headed "Work Being Pushed on New Boston-Chicago Cable," we stated that the American Telephone and Telegraph Co. cable was being built at a cost of $200,000 per mile. The figure was intended to be $20,000 per mile.

Bureau of Standards Gives New Data on Dry Cells

Washington, D. C.—The recently adopted standard sizes and tests for dry cells and flashlight batteries, together with much additional data, are given in a revised edition of Circular 79, issued by the U. S. Bureau of Standards. These tests and sizes were adopted by a conference of the leading manufacturers, government representatives, and the largest individual users which met at the Bureau of Standards in December, 1922. The electrical theory and construction of various kinds of dry cells are given in this circular, together with a discussion of the various kinds and the types of service for which they are intended. About half of the circular is devoted to a discussion of the electrical characteristics of dry cells, including their behavior in circuit; the internal resistance of dry cells; method of grouping cells; effects of temperature on the voltage, current, and capacity; and the capacity of dry cells discharging under various conditions of service. Standard tests for dry cells are described, and specifications for the performance of the standard sizes of cells and batteries are given in the appendix. This circular, entitled "Electrical Characteristics and Testing of Dry Cells" may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., by asking for Circular 79 (second edition); price, 15 cents.

Tri-State Tele. & Teleg. Co. Has a Good Year

St. Paul, Minn.—In sending out the seventy-ninth quarterly dividend on the preferred stock of the Tri-State Telephone and Telegraph Co., Pres. G. W. Robinson presents a condensed financial statement of the company for the year ending Dec. 31, 1922. The company has been able to pay a return of 8 per cent on the common stock for the first time in six years. This was made possible through operating economies in all departments. The labor turnover has been reduced and, although the station growth has been approximately 3,000, the number of employees has been stationary. The amount paid for labor for the year aggregated 47 per cent of the total receipts for service rendered. Maintenance and depreciation required 32 per cent of the gross receipts and taxes which continued to increase absorbed 4.8 per cent of the total receipts. The strong financial condition of the company is shown by the fact that current assets are three times current and accrued liabilities and sufficient cash is on hand to liquidate all current indebtedness.

KANSANS GATHER

Record Convention at Ottawa Featured by Profitable Business Talks

ELECTED BY KANSAS

T. L. Youmans, Osawatomie, Pres.
A. J. Stevens, Hiawatha, First V. P.
Bruce Goff, Wakeeney, Second V. P.
J. A. McDonald, La Harpe, Third V. P.
H. L. Harris, Kansas City, Treas.
Miss M. J. Hancock, Kansas City, Asst. Treas.
Executive Committee—H. L. Harris, Kansas City; Samuel Tucker, Pleasanton; Fred Coulson, Abilene; C. C. Raymond, Greensburg; J. A. Gustafson, Fredonia; J. H. Campbell, Baldwin; Foster Lenning, Tonganoxie.

Ottawa, Kan.—As an indication of the prevailing activity in the telephone business, the Kansas convention affords a good barometer every year. This year, in attendance, in exhibits, in practical value of the papers and the business done by the exhibitors, the Kansas Independent convention set a new high mark.

Practical papers were presented on "Open Wire Splicing," by O. P. Nokes of Yates Center; "Telephone Test Sets," by Charles Hughes, plant chief at Lawrence, and on "Cable Splicing," by V. C. Parr of Emporia. A radio address was given by M. F. Potter. The radio discussion brought out the success of the radio exchange being conducted by J. A. Gustafson of Fredonia. He has 60 subscribers at present, and more orders than he can handle.

F. B. MacKinnon, president of the national Independent organization spoke on the national telephone situation and stressed the need of closer cooperation. J. K. Johnston, of Indianapolis, was present on a recruiting mission for the Pioneers and stirred up a Kansas branch of the Independent veterans' body, which begins operations with a charter roster of 14.

Chief accountant Buchanan of the Kansas Public Utilities Commission gave the convention some helpful advice on preparing the annual reports for class C and class D companies. John B. Maling's address on "Class and Freak Legislation," which has been well received at other telephone conventions, also was a Kansas feature. Other talks were made by E. C. Blomeyer of the Automatic Electric Co. and J. H. Ainsworth of the Kansas Commission.

A successful operators' school was conducted by W. S. Vivian during the time the regular convention sessions were being held.

"LONE STAR" SESSIONS SHINE

Texas Convention Has National Aspect in Program—Well Attended

TEXAS ELECTS

R. B. Still, Tyler, President.
F. W. Greber, Brownwood, V. P.
John Y. Rust, San Angelo, V. P.
L. S. Gardner, Waco, Secretary.
J. C. Paxton, Sherman, Treasurer.

Dallas, Tex.—Three paramount needs of Independent Telephone companies today are finance, proper engineering, and scientific operation, said R. B. Still, president of the Texas Independent Telephone Ass'n. in a notable address which opened the 18th annual convention of the organization. The status of Independent telephony in Texas also was cited by President Still, who referred to the ignorance of the money-lenders of the state relative to the safety of an investment in telephone property.

This matter of financing came up later in the convention when Judge S. A. Lindsay of Tyler spoke on the financing plans of Independent telephony and proposed a plan of financing the smaller companies on a basis similar to that of building and loan associations, the loan plan to be supervised by the association's officials.

Doubt as to the existence of a legislative menace was expressed by Judge Harrison, president of the West Texas Telephone Co. in his talk. Criticism of the crop credit system and of the lack of thrift in spending state tax money was made by Nathan Adams, a prominent Dallas banker, who spoke before the convention. F. B. MacKinnon reviewed the status of the Independent sector of the industry and the work of the national association in bettering relations between Independent and Bell connecting companies.

George McQuaid spoke of the need, purposes and functions of the Texas Public Service Information Bureau, which he has successfully headed for some time past.

A reminiscent address by E. C. Blomeyer of Chicago, a former Texan, and at one time president of the Texas association, brought out the progress that has been made in reconciling Independent and Bell differences.

The strictly technical part of the convention was featured by papers of considerable practical value, among them being a comparison of Bell and Independent methods of handling long distance calls, given by V. E. Cooley of Dallas; "Standard Engineering Practices," by F. W. Greber, Brownwood; "Underground Cable Construction," by R. W. Garner, Waco; "Outside Plant Construction and Maintenance," by Herrick Johnson, Texarkana; "Storage Battery Installation and Maintenance," by C. D. Kinne and "Switchboards—Their Installation and Care," by Sam B. Dibble of Waco.

Sam S. Shutt of Waco suggested methods of developing toll business in his well received address.

Two of the brightest spots among an array of papers of strong interest were the addresses of J. C. Paxton of Sherman on "Are You Making or Losing Money," which was illustrated by charts, and that of C. A. Shock of Sherman on the value of vision in business. Mr. Shock also officiated as toastmaster at a dinner given to the exhibitors by the officials of the associaiton.

At the association's annual banquet E. C. Blomeyer presided as toastmaster, and brought into the spotlight several prominent figures in Texas telephony. Mary Jane Eldridge, a lovely little youngster, who is the daughter of Mr. and Mrs. Frank Eldridge of Chicago, stopped the show with her dances.

Seventeen directors were chosen at the concluding session.

NORTH DAKOTA MEETS

Considers Radio—Practical Problems Talked Over—Have Public Program

ELECTED AT NORTH DAKOTA

M. M. Borman, Abercrombie, Pres.*
H. A. Brown, Cooperstown, V. P.*
F. R. Iron, Starkweather, Sec-Treas.

Grand Forks, N. D.—Representatives of almost every telephone company of consequence in North Dakota brushed up on their work at a practical three-day convention of the North Dakota Telephone Assn. held here March 13-15. Radio, of course, came in for considerable discussion, Jay Houghtaling of St. Paul starting the topic on its way. He declared that the need for privacy in many telephone conversations restricted radio to its present field. Prof. Beyer of the University of North Dakota also lectured on radio, showing construction, and explaining operation by blackboard drawings.

Rates and regulations were covered in the address of R. H. Morris. Public relations from the telephone company's angle were the subject of the address made by Thomas Phalen, traffic superintendent for the Dakota Central at Aberdeen. From the public's view point the matter was handled by J. F. Bacon, general manager of the Grand Forks Herald.

*Re-elected.

"Other Line Charge," covering the practice of charging for connecting calls from small mutual companies, over long distance wires, also was discussed at the meeting.

A traffic conference paid special attention to precision in ticketing, and emphasized the desirability of station-to-station business due to the speed with which it can be handled.

A strong point of small company construction standards up to those of the larger companies was made in the remarks of A. T. Nicklawsky of the Traill County company at Hillsboro.

One of the features of the meeting was a public program given Tuesday night at which a demonstration of the use of the telephone, movie reels (among them those showing the laying of the Key West-Havana cable) and musical numbers were presented.

Accident prevention, collection methods, and legislative matters also received the convention's attention.

A merry banquet, with Charles Hall of Omaha, as toastmaster, was given prior to the Wednesday evening dance. Speakers at the banquet included: Martin Colton, W. W. Blain, C. E. Ladd, Philip R. Bangs, Paul Bunce and Richard Wenzel, all of Grand Forks; R. H. Morris, chief engineer of the North Dakota Railroad Commission, Bismarck; Thomas Phalen, of the Dakota Telephone Co., Aberdeen; J. A. Houghtaling of the Northwest Equipment Co., St. Paul; Mr. Sargent, Minneapolis; Ray Palmer of the Monarch Telephone Mfg. Co., Chicago; S. G. Harris of Page & Hill Co., Minneapolis.

Telephone Men at Utility Meeting in Oklahoma

Oklahoma City, Okla.—Among prominent telephone men at the annual convention of the Oklahoma Utilities Assn. were F. B. MacKinnon, president of the U. S. I. T. A.; J. G. Mitchell, sec.-treas. of the Illinois Telephone Assn. and J. W. Gleed of the Southwestern Bell Telephone Co.

The keynote of the convention was the improvement of relations of utilities with the public through more courtesy and service of company employees, through customer ownership of utilities and through advertising and taking the public into confidence of the operators and through other publicity sources. Figures were submitted showing that the people now actually own and control the public utilities through their investment in securities and indirectly through their investment and deposits in banks and in insurance policies.

"ON WISCONSIN"

Financial Problems Take Center of Stage at Milwaukee Meet

WISCONSIN OFFICERS

H. A. Price, Markesan, Pres.
Arthur Taylor, Rhinelander, V. P.
W. F. Goodrich, La Crosse, Treas.
J. A. Pratt, Madison, Sec'y.

Milwaukee, Wis.—Consideration of telephone company financing occupied the greater part of the time at the fourteenth annual convention of the Wisconsin Telephone Ass'n. held here March 21-23.

Morris F. Fox, a Milwaukee investment banker made an impressive address on "Increasing Interest of Investors in Public Utility Securities," rating them next to government or municipal bonds for safety, and forecasting that if cities do not pause in "their mad rush to create debts bigger than posterity can and will patiently assume," municipal bonds will have to run second to those of utilities.

Other financial phases were covered by the talks of S. L. Odegard of Madison on "What Constitutes a Permanent Telephone Investment," and by Walter Gallon of Antigo, who led the discussion on "Famous Sleet Storms and Their Lessons." Necessity of being able to finance rebuilding stood out as a prime lesson of the sleet storms.

Practical demonstrations of resuscitating electrocuted persons and of proper switchboard operation were given. The first, by E. J. Kallevang of the Wisconsin River Power Co., and the latter under the supervision of F. M. McEniry, general commercial superintendent of the Wisconsin Telephone Co.

Consideration of the Wisconsin road building campaign in its relation to telephone development and state and federal regulation of telephone companies followed the interesting speeches of M. W. Torkelson of the Wisconsin Highway Commission and George C. Matthews, chief statistician of the Wisconsin Railroad Commission.

The convention resolved to solicit the aid of Wisconsin congressmen in getting the federal transportation act modified so that it shall not include telephone companies, except interstate toll companies.

A proposal regarding financing of the association was referred to the directors, to be considered by the members at the next regular meeting.

Chicago, Ill.—Public utilities of the country must spend $2,750,000,000 before they are back on a pre-war basis. This year three-quarters of a billion must be spent in equipping new homes with utility service facilities.

FLORIDA THRIVES

Independents and Bell Boost Business Together at Brisk Meeting

FLORIDA RE-ELECTS OFFICERS

W. G. Brorein, Tampa, Pres.
W. L. Moor, Tallahassee, V. P.
F. D. Moor, Tallahassee, Sec.-Treas.

Miami, Fla.—Florida's reputation as a playground for the nation is exceeded by its reputation as a work shop for telephony, judging by the interest manifested in the practical program presented at the successful state convention here, March 27-28.

Independents and Bell companies have been meeting together at Florida state conventions for some time past. Evidence of the co-operation is apparent. One of the addresses, that by W. D. Adkins, of the Southern Bell, stressed the inter-dependence of the two factors. Mr. Adkins talked about necessity of team work in toll business.

A. B. Greene of the Florida Railroad Commission spoke on the use of statistics in forecasting service requirements. The plank pole was discussed by Leland Hume, V. P. of the Southern Bell, who told of the light weight, firm standing qualities of the pole and its perfect creosote penetration.

Financial problems were discussed by Frank B. Shutts, president of the South Atlantic company, which was the convention's host, and by A. B. Steuart, general auditor of the Peninsular of Tampa, who emphasized the necessity of keeping complete plant accounts.

Practical advice on the development of harmonious public relations was given by C. H. Galloway of Winter Park.

President MacKinnon of the National Independent Association was a speaker. He told of the importance of an attractive reward to the management, as a big consideration in rate making, and of the concern given by Class C and D companies by problems of finance and personnel.

A committee to secure uniform practice among companies wherever possible, was appointed by the convention.

Mount Vernon, Mo.—R. M. Snow of Kansas City has bought the Sarcoxie exchange of the Mount Vernon Telephone Co.

New Haven, Conn.—Nearly $500,000 has been paid in sickness and accident disability cases to Southern New England Telephone Co. employees by the Benefit Fund established 10 years ago.

Valuation in Rate Making

Chapter XIII—Unit Costs (Continued)

By Charles W. McKay, Associate Editor*

In the March installment we concluded our general consideration of the subject of the unit costs used for appraising the outside plant. There still remains, however, a large and important group of unit costs—those involved in the appraisement of the central office, subscriber's station and miscellaneous equipment.

Considering first the central office unit cost—let us first review the instructions of the Interstate Commerce Commission as to the proper allocation of this portion of a telephone property. The central office equipment, it will be remembered, is all included under the General Account 220. This account, in turn, is sub-divided into Account 221—"Central Office Telephone Equipment" and Account 222 "Other Equipment of Central Offices."

With respect to Account 221—Central Office Telephone Equipment—the instructions prescribed by the Interstate Commerce Commission state that: "This account should include the cost of local and toll switchboards, chief operators, monitors, and supervisors desks and tables, wire chief's testing outfits, main and intermediate frames, cables and jumper wires, call registers or meters, relay racks and coil racks, and power plants—including rectifiers, generators, engines, motors, batteries, power switchboards, meters and fuse boards; telephone and telegraph instruments and other electrical instruments and apparatus in the central office, devoted to the operation of the telephone plant."

In connection with the derivation of the unit costs, Account 221 should be sub-divided as follows:

(1) Switchboards.
  (a) Exchange switchboards.
  (b) Toll switchboards.

(2) Desks.
  (a) Chief operators' desks.
  (b) Monitors' and supervisors' desks.

(3) Wire chiefs' desks, including testing equipment, complete.

(4) Frames and racks.
  (a) Main frame.
  (b) Intermediate frames.
  (c) Relay racks, etc.

(5) Power plant.
  (a) Engines.
  (b) Generators.
  (c) Motors.
  (d) Storage batteries.
  (e) Rectifiers.
  (f) Power switchboards, including all equipment.

(6) Cabling and wiring.
  (a) Central office switchboard cables.
  (b) Jumper wires and other miscellaneous wiring.

Appraising Exchange Apparatus

Considering the first subdivision—switchboards—a complete description of the switchboard will be available from the inventory. Given this data, it will be possible to determine a unit cost for the board installed—based upon five-year averages. This unit cost may, in some cases, include all equipment, while in other cases it may be advisable to subdivide the board into its component elements, evolving one unit cost for the frame and separate unit costs for the various component elements.

If the board under appraisement has been purchased during the five-year analysis period—it should be a comparatively simple matter to obtain the actual original purchase price from the manufacturers who installed the board. This price, however, will only cover one year of the analysis period—and it may not include certain equipment which has been added since the board was first installed. By conferring with the manufacturers' engineers, however, one is able to get satisfactory unit costs for equipment installed subsequent to the original installation and to determine the reproduction costs for the years (included in the five-year analysis period) other than the year in which the board was purchased.

The same general method of procedure should be adopted with respect to Item 2, "Desks," and Item 3, "Wire Chiefs' Testing Equipment."

In building up the unit costs for Item 4, "Frames and Racks," difficulties may be encountered, in view of the fact that the frame may be the product of one manufacturer while the protective equipment may have been manufactured by others. If we adhere strictly to the general principles, as hereinbefore outlined, for guidance in evolving unit costs, it is thought that a satisfactory solution will be effected by applying ordinary "common sense" rules.

With respect to Item 5, Power Plant Equipment, it is thought that it will not be necessary to enter into a detailed discussion of ways and means of solving this portion of the unit cost problem. Suffice it to say that five-year average material and labor unit costs should be determined and that these costs should be properly assembled, for each of the sub-items: "Engines," "Generators," "Motors," etc.

Extreme care should be exercised in developing the unit costs for the item, "Cabling and Wiring"—Item 6. A vast amount of labor is involved in properly "forming" and terminating central office switchboard cables. This fact should be accorded full recognition in building up the central office cable unit costs. In this connection, it may be well to remind the reader that the central office switchboard cables start at the main frame and extend from this point to the intermediate frames and switchboards. It will be remembered that the cables extending from the main frames to the pothead splices are included under the general category of "Outside Plant" and are chargeable, specifically, to Account 245, Exchange (or Toll) Underground Cable.

Sub-item (b), "Jumper Wires and Other Miscellaneous Wiring," includes only the wiring which has to do with the telephone equipment. All electric and power wiring will, of course, be considered in connection with Item 5, "Power Plant," unless it is wiring which is used in conjunction with the building lighting circuits. In the latter case, where wiring may be directly allocated to the building lighting circuits, it will, of course, be included under Account 212—"Buildings."

In conjunction with the central office telephone wiring, it may be said that the general methods outlined throughout this discussion of unit costs, should be adhered to—in other words, five-year average prices and costs should be determined in connection with the evolution of all of the central

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office unit costs. It is also suggested that the amount of detail, necessary for building up the wire costs, should be left largely to the discretion of the appraisal engineer. So much wiring is involved that if an attempt were made to inventory and appraise the central office wiring in detail, the cost of the work would be entirely out of proportion to the value of the plant appraised.

Account 222—Other Equipment of Central Offices:

If we adhere to the dictates of the Interstate Commerce Commission—"This account should include the cost of furniture and equipment (other than telephone equipment) in central offices for the operating forces. This account includes the furniture and equipment in operators' rest, retiring and lunch rooms and in the operators' training schools."

With the exception of the equipment in the operators' training schools, the valuation of this portion of the central office equipment is a comparatively simple problem. It merely requires the application of suitable unit prices to tables, chairs and other items of furniture and equipment.

Many telephone companies, however, maintain elaborate schools for training operators. These schools are equipped with "dummy" switchboards and all of the necessary appurtenances for training operators. In appraising such switchboards, in so far as the unit cost problem is concerned, the methods hereinbefore described, in connection with "Central Office Telephone Equipment" should he adhered to.

Station Equipment.

The station equipment account (Account 230—under the Interstate Commerce Commission System of Accounting) includes the following subdivisions:

(1) Station apparatus—Sub-account 231.

(2) Station installation—Sub-account 232.

(3) Interior block wires—Sub-account 233.

(4) Private Branch Exchanges—Sub-account 234.

(5) Booths and special fittings—Sub-account 235.

Methods of evolving unit costs for interior block wires (Sub-account 233) have been discussed in a previous installment in connection with the outside plant. As a matter of fact, interior block wires are, as a general rule, a part of the outside plant. In other words, a sharp distinction should be drawn between the interior block wires and the interior wiring used in connection with subscribers' station installations.

As suggested—also, in a previous installment—in connection with the inventory of the outside plant, it is customary to accumulate data which may be used as a basis for evolving subscribers' station equipment unit costs. A form similar to the one presented in Fig. 31 should be used.

Material at Subscribers' Station

Subscribers' Instruments		Subscribers' Installation Data (Wire)	Subscribers' Installation Data (Misc. Materials)	General Notations
No.	Kind	Feet	(To be filled in accordance to the requirements of the case in hand)	
...	.....	....	.....	.....
...	.....	....	.....	.....

Fig. 31. Field Sheet for Tabulating Data as to Subscribers' Station Equipment. (For subsequent use in developing the unit costs.)

As previously stated in connection with the discussion of inventory methods, it is, of course, out of the question to make a detailed inspection and inventory of each and every subscriber's station. Enough data, however, should be gathered, through the medium of a field sheet of the form suggested in Fig. 31, to facilitate the Appraisal Engineer in arriving at definite conclusions as to **average** conditions and to assist him in building up the unit costs. The actual quantities, of course, will be obtained from the operating company's books and records. The unit costs, when completed, may be directly applied to the inventory quantities as obtained from the records.

In some cases, it is customary to so derive the subscribers' station unit costs as to include both the cost of the instrument in place and the cost of installing the auxiliary wiring and equipment in one unit cost. In most cases, however, the method prescribed by the Interstate Commerce Commission is strictly adhered to. In other words, station apparatus unit costs are segregated from station installation unit costs.

To clarify this phase of the problem, it may be well to quote the instructions of the Interstate Commerce Commission. With respect to station apparatus, the instructions state that "this account should include the cost of station apparatus, such as telephone sets, intercommunicating sets, bells, backboards, desk stands, coin boxes, protectors, battery boxes, initial batteries and cords, special station switching devices not otherwise classified, and telephone and telegraph instruments or parts thereof when owned by the company and installed for service."

Defining "Station Installations"

With respect to "Station Installations," Account 232, the instructions specify that: "This account shall include the cost of installing apparatus and the cost of inside wire—that is, the wires (or cables) from the instruments to the point of entrance to the building, where the drop wires or interior block wires terminate; or to the junction boxes, where the house cable or other cable terminates, including wires on the same premises to connect main and extension stations; or to connect the private branch exchange distributing frames with their terminal stations."

In other words, if we adhere strictly to the system of accounts as prescribed by the Interstate Commerce Commission, the unit costs for "Station Apparatus" will include only the cost of the apparatus itself, while the cost of installing the apparatus and all auxiliary wiring, equipment and so forth, will be included in a separate set of unit costs, evolved especially to cover "Station Installations."

In deriving the unit costs for "Station Apparatus" all available data as to instrument prices for the analysis period should be carefully reviewed. In most cases it will be found that a variety of types and classifications of instruments are utilized in one exchange. In such cases every effort should be made to segregate, and properly classify, the instruments—under the general captions "Wall Sets," "Hotel Sets," "Desk Type Sets," etc.

In such cases where a definite separation of the various classifications is a physical impossibility (due to the condition of the company's record data) "weighted" unit costs should be built up—making due allowance for the prevalent types of instruments. To illustrate, it may be found that 75% of the total number of instruments are of the hotel type, 20% of the desk type—while the remaining 5% are of the old-fashioned wall type. In a case of this kind, the unit cost—as applied to the total number of instruments in the plant—should be properly "weighted" to reflect the averages above quoted.

The form used for evolving the Station Installation unit costs should be somewhat similar to the one suggested in Fig. 32.

1 fuse, @ ....$.....
25 feet "Olive Green" Duplex inside wiring @..... .....
15 feet "Bridle Wire" (Duplex), @ ....
4 type — Porcelain knobs, @ .....
12 "Perfection" Nails, @..... .....
16 — inch Screws, @..... .....

Total Material .....$.....
Allowance for waste and lost material (at 2%)..... .....
Installation Labor ....

Total installation unit cost per station .....$.....

Fig. 32. Illustration of "Installation" Unit Cost

Type	Class Service	Cost of Instrument	Screws and Placing Material	Total	Total Plus 2%	Total Labor	Unit Cost
CITY							
COMMON BATTERY (S-C Co.)							
Hotel—Induction	Single	$.....	$.....	$.....	$.....	$.....	$.....
Hotel—Induction	Party	.....	.....	.....	.....	.....	.....
Hotel—Direct Current	Single	.....	.....	.....	.....	.....	.....
Hotel—Direct Current	Party	.....	.....	.....	.....	.....	.....
Desk—Induction	Single	.....	.....	.....	.....	.....	.....
Desk—Induction	Party	.....	.....	.....	.....	.....	.....
Desk—Direct Current	Single	.....	.....	.....	.....	.....	.....
Desk—Direct Current	Party	.....	.....	.....	.....	.....	.....
Wall—Induction	Single	.....	.....	.....	.....	.....	.....
Wall—Induction	Party	.....	.....	.....	.....	.....	.....
Wall—Direct Current	Single	.....	.....	.....	.....	.....	.....
Wall—Direct Current	Party	.....	.....	.....	.....	.....	.....
Intercommunicating	Desk 12 Button	.....	.....	.....	.....	.....	.....
Intercommunicating	Wall 12 Button	.....	.....	.....	.....	.....	.....
RURAL							
MAGNETO (S-C Co.)							
Wall with Batteries	Party	.....	.....	.....	.....	.....	.....
CITY							
EXTENSION BELLS (S-C Co.)							
Extension Bell	All	.....	.....	.....	.....	.....	.....
Coin Collector		.....	.....	.....	.....	.....	.....
Lightning Arrester		.....	.....	.....	.....	.....	.....
RURAL							
Extension Bell	All	.....	.....	.....	.....	.....	.....

Fig. 33—Subscribers' Station Equipment
(Example of Form for Combined Unit Costs)

Deviation From I. C. C. Practice

As previously suggested, it is sometimes advisable to deviate from the practice prescribed by the Interstate Commerce Commission and include both the apparatus and installation costs in one unit cost set-up. Examples of combined unit cost set-ups are presented in Fig. 33 and Fig. 34. Both are taken from recent actual appraisals.

		Item Price	Totals
Direct Line Wall or Desk—			
1	Wall or desk set complete		.....
¾	Protector (fuse cut out)	.....	.....
16′	Inside wire	.....	.....
10′	Duplex (Bridle) wire	.....	.....
1.7	Porcelain tubes	.....	.....
5½	Perfection nails	.....	.....
7½	Screws	.....	.....
	Total		.....
	Add 2% Loss and Waste		.....
	Total Material		.....
	Labor Installing		.....
	Total Cost per Station		.....
Party Line Wall or Desk—			
1	Wall or desk set complete		.....
1	Protector (fuse cut out)	.....	.....
1	Ground rod	.....	.....
12′	Inside wire	.....	.....
4′	Duplex (Bridle) wire	.....	.....
8′	Ground wire	.....	.....
1.8	Porcelain tubes	.....	.....
5	Insulated staples	.....	.....
3	Perfection nails	.....	.....
8	Screws	.....	.....
	Total		.....
	Add 2% Loss and Waste		.....
	Total Material		.....
	Labor Installing		.....
	Total Cost per Station		.....
Extension Wall or Desk—			
1	Wall or desk set complete		.....
32½′	Inside wire	.....	.....
5′	Duplex (Bridle) wire	.....	.....
½	Porcelain knob and screws	.....	.....
½	Porcelain tube	.....	.....
7.5	Perfection nails	.....	.....
4	Screws	.....	.....
	Total		.....
	Add 2% Loss and Waste		.....
	Total Material		.....
	Labor Installing		.....
	Total Cost per Station		.....

Fig. 34—Subscribers' Station Equipment
(Combined Unit Cost Form)

Private Branch Exchange Unit Costs

Quoting the instructions of the Interstate Commerce Commission "This account should include the cost of private branch switchboards, their distributing frames, the cables connecting such switchboards and distributing frames, and the cost of installation."

As suggested in the section of this series devoted to Inventory Methods, each private branch exchange should be actually inspected and all descriptive data recorded accurately. It may be necessary to evolve a separate unit cost for each private branch exchange as found in the plant—or it may be that a number of private branch exchanges are exactly similar and that one unit cost can be applied to the group.

In developing the private branch exchange unit costs—average material costs (for the analysis period) should be determined, insofar as possible, from the company's books and records. In connection with this phase of the unit cost problem, there are many factors to be taken into consideration. Aside from the switchboard itself, there is usually a terminal box for making connections and a cable must be run between the switchboard and the terminal box. Again, it is frequently necessary to install an interior cable system (entirely aside from any house cable system) for connecting the various subscribers' stations to the terminal box and thence to the switchboard. From an engineering stand-

point, especial attention should be paid to the proper location of the switchboard, the terminal box and the various extension stations on the switchboard.

In building up the unit costs for private branch exchange equipment, it is, of course, necessary to make due provision for all labor involved in placing cables, wires and so forth; for the cost of placing the switchboard; for the cost of placing the terminal—as well as for all of the material costs involved.

This phase of the unit cost problem is especially complicated due to the fact that no two installations are alike. The subscribers' requirements are a governing factor and it is also true (especially in the case of the older telephone companies) that many varying types of switchboards will be found in the operating plant. Some of these switchboards may be old—even so old as to be obsolete, from the standpoint of obtaining manufacturers' costs for the purpose of evolving a five-year average reproduction unit cost. In such cases, the appraisal engineer must rely, largely, upon his own knowledge and experience.

Booths, Special Fittings—Sub-Account 235

The telephone equipment falling in the category "Booths and Special Fittings" is necessarily somewhat varied as to its nature. For instance, modern telephone booths are equipped with electric fans, and auxiliary ventilating equipment. All equipment of this nature falls under Sub-Account 235 and provision must be made for the evolution of suitable unit costs.

To review the instructions of the Interstate Commerce Commission, relative to the account under discussion—these instructions state that "This account should include the costs of booths and special fittings, such as desks, chairs, fans and cash registers and the cost of installation."

It is hardly necessary to dwell at length upon the evolution of the unit costs for all of the items component to Account 235. Suffice it to say that five-year average material and labor costs, should be used—making the usual allowance for lost and waste material and, furthermore, a suitable allowance for the cost of direct installation supervision. It may be well, however, to add a word of caution as to the danger of confusing items which should be charged to Account 235 with the general furniture and fixture accounts. Items such as chairs (in booths), fans, cash registers and so forth, might easily be confused with other items belonging to the general furniture and fixture accounts—as a matter of fact, mistakes of this nature have occurred, frequently, in connection with actual valuation cases.

Unit Costs for General Equipment

In concluding the discussion of unit costs, it may be well to add a word as to the costs applicable to the general and miscellaneous items of plant—as encountered in the inventory and appraisement of the telephone property.

Account 260 "General Equipment"—to refer to the instructions of the Interstate Commerce Commission—"Should include the cost of equipment classified in the sub-accounts hereunder. Items of small value or short life, such as portable tools, liable to be lost or stolen, temporary shelving, waste baskets, plugs, whips and the like, should not be included in this account or the sub-accounts hereunder, but should be charged direct to the operating expense account or to the clearing accounts."

The General Equipment Account includes the following subdivisions:

Office Furniture and Fixtures—Account 261.

General Shop Equipment—Account 262.

General Store Equipment—Account 263.

General Stable and Garage Equipment—Account 264.

General Tools and Implements—Account 265.

It is hardly necessary to describe detailed methods for evolving unit costs applicable to the foregoing sub-accounts—but it may be well to present a brief résumé—based upon the instructions of the Interstate Commerce Commission as to what the sub-accounts include.

Office Furniture and Fixtures—Account 261

"This account should include the cost of desks, tables, chairs, carpets, cases, movable partitions, railings, shelves, typewriters, addressing machines, adding machines and other office devices; stoves, portable gas and electric fixtures and other office fittings (except fittings considered a part of the building as provided for in Account 212, Buildings, and telephone equipment provided for under Account 220, Central Office Equipment.)"

General Shop Equipment—Account 262

"This account should include the cost of all equipment especially provided for general shops, such as engines, gas producers, electric generators and other power apparatus used in operating machinery in shops; machine tools, shafting, belts and like shop equipment; also such smithing equipment in general shops, as is used principally for general purposes—other than the shoeing of horses and repairing of vehicles.

"Hand and other small portable tools liable to be lost or stolen should not be included herein, but portable tools and apparatus of special value may be charged to this account and remain herein so long as record is kept of such tools and apparatus."

General Store Equipment—Account 263

"This account should include the cost of all equipment of general stores, structures, such as movable counters, movable shelving and other movable equipment of like nature—carts, barrows, trucks, tools and so forth, and other apparatus and appliances used in handling, storing and packing tools and supplies. Counters, shelving and other like equipment **permanently attached** to the structure, should be charged to Account 212, Buildings, and **not** to this account."

General Stable and Garage Equipment—Account 264

"This account should include the cost of all equipment of general stables, including horses, harnesses, drays, wagons, automobiles and other vehicles; also the equipment of automobile repair shops."

General Tools and Implements—Account 265

"This account should include the cost of portable testing apparatus and valuable tools and implements devoted to the maintenance or construction of a telephone plant. It should not include the cost of small tools (which are apt to be lost—or which have to be replaced at frequent intervals). Short lived equipment of this nature should be charged to the operating or clearing accounts."

While discussing the General Equipment Accounts it may be well to outline the scope of the "Materials and Supplies Account"—Interstate Commerce Commission, Account No. 122.

Materials and Supplies—Account 122

"This account should include the cost of unapplied material, including the value of material temporarily in use and not charged out in the company's accounts. Articles in process of manufacture by the company; tools, fuel, stationery and other supplies. Freight and express charges paid on the material included in this account, should be included in the value of such material."

With respect to the equipment falling under all of the foregoing accounts, it may be said that the exercise of ordinary common sense in deriving and applying the unit costs is all that is necessary. Some appraisal engineers make the mistake of applying costs directly obtained from invoices—without giving due consideration to the fact that the whole appraisal scheme is predi-

cated upon the basis of five year (or whatever the analysis period happens to be) **average** unit costs. It also frequently happens that bills of material are utilized directly in evolving the unit costs for shelving, partitions and so forth—without making provision for the fact that it costs real money to install such items of plant and that the labor costs should be given due consideration in arriving at the total unit costs.

Right-of-Way—Account 207

Another item, which should be considered in evaluating a telephone property is the cost of right-of-way. It frequently happens that direct payments are made for the privilege of placing poles, wires, cable and conduit on private property—or that the equivalent of a direct payment is made for placing poles (or other plant) on highways. This "equivalent" may take the form of time spent for securing necessary city permits or time spent in settling disputes with property owners.

To quote the instructions of the Interstate Commerce Commission, Account 207—"should include the cost of all land and interests in land required for the location of telephone wires, cable, pole lines and conduits; salaries and expenses of right of way agents; expenses of appraisals and of juries, commissioners or arbitrators in condemnation cases; real estate brokers' commissions; cost of plats, abstracts, notarial fees, examinations of titles, recording of deeds, etc."

From the foregoing it will be seen that there is ample precedent—as established by the Interstate Commerce Commission for the evolution of a complete set of costs to cover the right of way account. Right of way, in general, may be divided into three classifications:

1. Right of way for poles, wires or cables located on public highways.

2. Right of way for poles, wires or cables located on private property.

3. Right of way for cables, wires and cross-arms placed on poles of "foreign" utility companies.

In evolving right of way unit costs, it is usually customary to make a more or less theoretical determination of the total right of way expense—and then to allocate this total expense to the individual units as outlined in the foregoing paragraph.

Assume that we are appraising a property on a reproduction basis and have determined, in detail, the length of time which will be required for the various operations. Given this information, it should be a comparatively simple task to determine how long a period will be required to obtain the necessary rights of way and to build up a budget covering the expenses incidental thereto. An estimate of this nature would take somewhat the following form—(the illustration cited has been taken from a recent actual appraisal):

4 right of way agents attached to construction crews, for a period of 1½ years at $.... each .....$.....
1 clerk in charge of right of way records for a period of 1½ years ....
Depreciation, maintenance and operating expense of automobile during 1½-yr. period... .....
Total legal expenses involved in securing right of way..... .....
Incidental expenses (car fare, telephone, etc.) ....
Special payments made for acquisition of right of way.... .....

Total.....$.....

In the May installment, a brief summary will be presented of the unit cost problem—together with an introduction to the subject of "Collateral" or "Overhead" Costs.

CO-OPERATION IN EDUCATION

Illinois Utilities Plan for Educating College Men for Utility Business

Springfield, Ill.—The Committee on Co-operation with Educational Institutions which was formed for the purpose of drafting a platform for co-operation on the part of the utility companies of Illinois with the educational institutions of the state has submitted a report to the various associations and companies represented on the committee. The committee's report is divided into two general heads, educational work and executive and personnel work, and a number of suggestions are made in each division.

Under the main division of Educational Work the report recommends the encouraging of adoption of curriculums and courses in public utilities at the colleges and universities. Measures should be taken to awaken and stimulate interest among the colleges in this branch of economic and industrial education and to assist in broadening such courses after adoption by the colleges. Such arrangements should allow men in engineering courses to take work in public utilities and men in business courses to take work in engineering. Arrangements to have talks before freshmen and the general student body by noted men in the utility industry and arrangements for supplying educational literature and publicity material should be made.

Other suggestions under educational work deal with the appointment of undergraduate correspondents at the colleges, co-operation by the utilities and manufacturers in supplying apparatus especially to the engineering departments and provision for opportunity for advanced students to put their instruction into actual practice by being given responsibility of operating, under supervision, integral parts of the utility plants.

It is also suggested that the co-operation extend to high schools, preparatory schools and elementary schools. This would include supplying speakers to the schools and furnishing pamphlets and bulletins to school libraries and classes. Trips to public utility plants would be arranged and courses in industrial arts dealing with public utility education should be included in curricula of vocational schools.

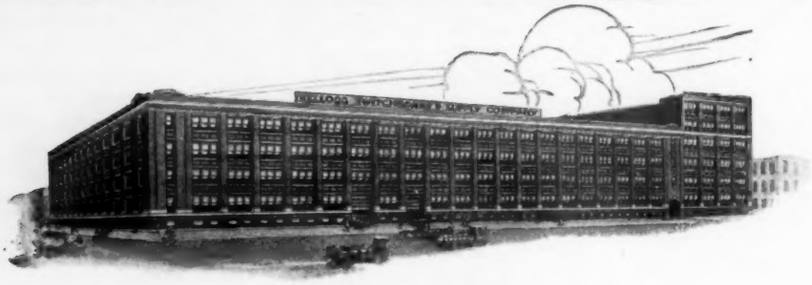
The committee has considered under Executive and Personnel Work a plan to assimilate and develop the graduate students made available by the schools. In the opinion of the committee this is the keystone of the entire plan. The committee proposes that each utility company appoint an executive, as near the top as possible, with authority to co-operate with the committee in its plan; that each company pledge itself to take into its organization a specified number of graduates from colleges of Illinois who have shown ability in this field; that the companies pledge, as far as they are able to commission professors to undertake special work and to give undergraduates summer work and that the utilities utilize the special knowledge of the faculty members in solving special problems and for lectures and addresses before groups of utility men.

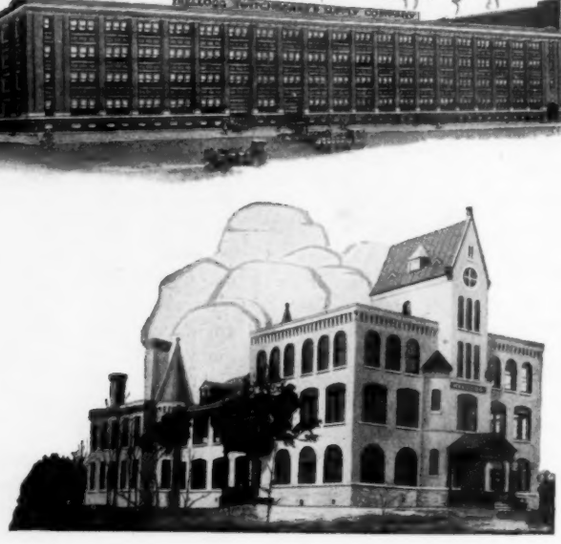
Under personnel work the committee recommends a procedure for the supervision of college men who enter the companies and makes some suggestions as to the policies that should govern the policy of the companies in dealing with these men.

The committee in submitting its plan notes that it is effective to a certain extent at the present time and proposes that the work be reinforced.

The committee represents the Illinois Gas Association, the Illinois State Electric Association, the Illinois Electric Railway Association, the Illinois Telephone Association, the Illinois Bell Telephone Company and the Illinois Committee on Public Utility Information. Jay G. Mitchell, secretary of the Illinois Telephone Association, and G. W. McRae, chief engineer of the Illinois Bell Telephone Company, are the telephone representatives on the committee.

Great Growth from Kellogg's Cradle





To the right is shown the old school-house that was the Kellogg Switchboard and Supply Co.'s first factory

Above is evidence of the Kellogg growth; for today every inch of this plant's space is demanded by the business

AND STILL GROWING

Wonderful Progress Made By the Kellogg Switchboard & Supply Co.

Chicago, Ill.—The Kellogg Switchboard and Supply Co. started in an old school building near Chicago with just a few men. Building for real public service, the business grew, and one factory after another was outgrown, until in 1915 the present building on the west side of Chicago was called for. This factory contains over fourteen acres of floor space, and ranks among the largest and most up-to-date factories in the world for the production of telephone equipment. Since the first shipment of telephones by this company, the same "Kellogg" has had much to do with the progress of the telephone industry. Free to develop telephone engineering along the lines of public demand, and aided by constant research and experiment, the Kellogg Co. has been of great assistance to better service, not only in the larger cities, but in small towns and villages throughout the world. Largely through their continuous and dependable efforts, telephone managers have been able to secure equipment of the most modern type, and to serve telephone subscribers in the most efficient manner.

One has only to recall the crude and limited telephone service offered after twenty years of development, when Kellogg entered the field in 1897, to appreciate the service rendered by this progressive company. Among the achievements it claims are the following: Economical party line systems for small town telephone users, as well as larger city exchanges; the Kellogg transmitter, first real Independent product of 20 years ago and today, practically unchanged, with more than 300,000,000 in service; the first really unbreakable desk telephone, the first receiver without outside connections from which people received shocks, and Kellogg receiver shells, practically unbreakable. Over 20,000 Kellogg switchboards now are in use, low in first cost and saving in maintenance. It is worthy of note, too, that Kellogg telephones and switchboards are standard and can be used with any operating system.

Standard Underground Cable Co. Moves to New Plant

Pittsburgh, Pa.—The Standard Underground Cable Co., April 1, moved its general offices and Pittsburgh sales office to the company's new factory and office building at 100-108 Seventeenth street. The new building is a four-story brick and steel structure, occupying the entire block between Sixteenth and Seventeenth streets. This block was the site of the company's first factory, erected in 1883. The Standard Underground Cable Co. also announces the opening of a branch of its St. Louis sales office in the Scarritt Arcade Building, 817-819 Walnut street, Kansas City, Mo. E. H. Shutt, who has been with the company for several years, will be in charge of the new office as district sales agent.

DEPRECIATION HEARING

I. C. C. to Hold Session on Telephone Depreciation

Washington, D. C.—May 1 the Interstate Commerce Commission will hold a hearing at Washington at which telephone companies will have an opportunity to express their opinion of the proposed regulations regarding depreciation.

The United States Independent Telephone Assn. has sent a copy of the I. C. C. Order No. 14700 on Depreciation Charges of Telephone Companies to the association members, together with a letter which states:

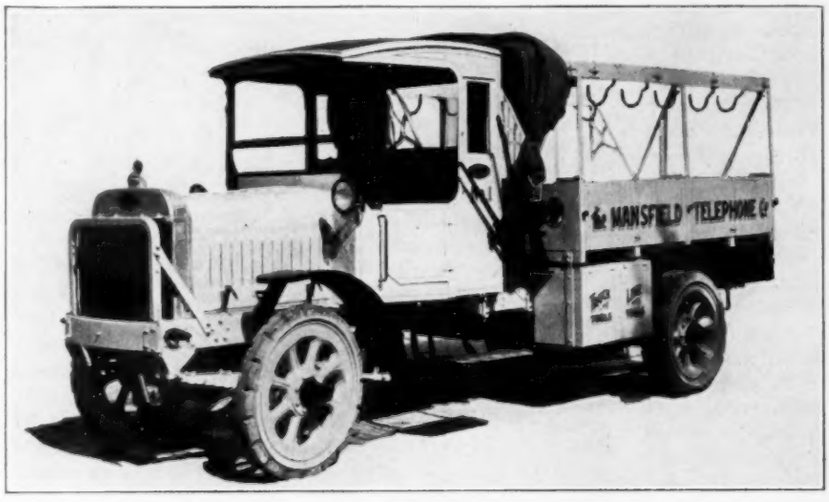
"The Association, as you know, filed a statement with the commission two years ago expressing for its members our idea of the plan the commission should pursue in complying with the law which requires the commission to prescribe a depreciation procedure for telephone companies. The Association will be prepared to represent its members at the hearing May 1. In order that we may be able to do so with a clear idea of the attitude of our members we would appreciate an expression of opinion from all of them. Therefore, as soon as you have given the enclosed order careful consideration, please write us at our Chicago office, 19 South La Salle Street, and tell us what you think about the procedure the commission proposes to put into effect."

Gainsboro, Tenn.—Gainsboro Telephone Co. has bought the Carthage Home Telephone Co., its sole competitor.

P. A. Collins with North Electric Mfg. Co.

Galion, O.—Paul A. Collins, formerly Washington representative of the Automatic Electric Co., has been appointed assistant manager of the P. A. X. department of the North Electric Mfg. Co., Galion, O. In 1902, after a course at the School of Applied Science, Harvard University, Mr. Collins entered the Traffic Engineering Department of the American Telephone and Telegraph Co., and was engaged for several years on fundamental development plans, checking of traffic data and special investigations for studies of telephone operating methods and practice. In 1909 he was made assistant supervisor of traffic for the Southwestern Telephone and Telegraph Co. of Dallas, Tex., and a year later the Bell Telephone Co. of Missouri appointed him manager of traffic inspection at St. Louis. A few months later he became assistant superintendent of traffic and, in May, 1911, superintendent of traffic for the company. In 1911, F. L. Gilman, then general manager of the Missouri and Kansas Telephone Co., transferred Mr. Collins to Kansas City to assist the general traffic superintendent in the standardization of traffic methods in accordance with the methods and routines originated by the Engineering Department of the American Telephone and Telegraph Co. Returning to St. Louis seventeen months later, he was placed in charge of all traffic methods, instruction and standards, including the operation of the telephone and telegraph service for the Southwestern Bell Telephone system, which then included Missouri, Kansas, Arkansas, Oklahoma and Texas. On account of temporary ill health in 1914, Mr. Collins resigned and returned to Boston. Shortly after, the Automatic Electric Co. requested him to take charge of sales work in New England, and he was acting as New England manager just prior to accepting a commission in the Signal Corps of the U. S. Army, May 2nd, 1918. After three months' service in the United States and a year as telephone and telegraph traffic officer, intermediate section, S. O. S. A. E. F., he returned to the United States, was discharged August 4th, 1919, and resumed his former position with the Automatic Electric Co. During 1919-1921 he handled sales and engineering methods in New York, and the past year conducted negotiations for Automatic Electric Co. with the United States Government as their Washington representative.

Paul A. Collins, Telephone Expert, Who Joins North Staff



Gramm-Bernstein Special Built for Mansfield, Ohio

A HEAVY-DUTY "SPECIAL"

Experts Collaborate on Truck Specially Designed for Telephone Work

Mansfield, Ohio.—A 4-ton Gramm-Bernstein truck recently put into the service of the Mansfield Telephone Co., is claimed to be one of the most practical jobs of its kind for heavy construction work in the telephone industry.

The telephone features of the truck are an achievement of Gustav Hirsch, the well known telephone engineer, and were given particular attention in all details that would promote speed and economy in construction.

This truck is being used as a general utilities truck for heavy duty work, is equipped with a Bay City winch and a tripod derrick, and is used in the pulling of underground or aerial cable, in the setting of poles or the pulling of poles, and will set poles across ditches or in most any position that a pole is needed without special work, this being done by an out-board shoe.

The truck is equipped in such a way that the heavy construction gang can carry everything that they need, their cable wheels and two trailers if necessary.

In addition, the truck is likewise equipped with two compartments for safety first apparatus, namely breathing machines, rubber gloves and first aid kits.

The truck has proven itself in every possible way and seems to be foolproof.

The winch is a special Bay City "Type D" and has a direct drive from the patent Gramm-Bernstein power take-off on the transmission.

In the Gramm-Bernstein shops the Mansfield job was given the personal attention of W. J. Gramm, chief engineer and factory manager, as the sales and service possibilities of these trucks in the telephone industry were judged especially inviting. W. J. Gramm is the son of the company's vice-president and has been brought up with trucks since he stepped out of his swaddling clothes. The head of the family put him through a thoroughly practical truck training course, which was polished off and extended at the Case School of Applied Science. The younger Gramm's aptitude for truck engineering and construction qualified him to figure prominently in government truck construction and operation during the war.

Galveston, Tex.—As part of its salesmen's training course, the C. W. Thompson Co. took its new employees on an inspection tour of the Southwestern Bell plant here. The candidates were instructed in the proper method of telephone conversation. One hundred made the inspection.

Practical Plant Problems

Chapter XIII—Review of Engineering Practice

By Charles W. McKay, Associate Editor*

The present series of articles started in the March, 1922, installment of the "Telephone Engineer"—over a year ago. The first section of the series, as it was originally outlined, was to be devoted to the practical application of plant engineering methods and the second section to problems of a construction nature.

Before taking up the second section, which will be started in the May installment, it may be well to review, briefly, the general subject matter as presented during the past year.

In an excellent article appearing in the February, 1922, installment of "Telephone Engineer," Prof. R. V. Achatz referred to engineering as "the art of directing the great resources of power in nature, for the use and convenience of man" and also as "the determination of the most economical method of achieving a desired result." Prof. Achatz qualified the second definition by saying that it is "complementary" to (or in other words a complement of) the first quoted definition. "The former," says Professor Achatz, "defines the scope of the engineer's work, while the latter defines his method of procedure."

In this connection, it might be well to add that telephone engineering, and especially telephone plant engineering, is engineering in the broadest sense of the term. The telephone engineer is called upon every day to make practical decisions in matters where good judgment and plain, ordinary, common sense are of prime importance—in fact, of perhaps more importance than technical knowledge.

It has not been the purpose of this series of articles to train the readers to be telephone engineers, but rather to so present the fundamentals of plant engineering as to supplement the practical knowledge of the operating telephone executive in such a way as to afford him every possible aid in solving daily maintenance and construction problems.

Four Divisions of Telephone Engineering

At the beginning of this series it was stated that telephone engineering could be divided into these four important subdivisions: Plant Engineering, Commercial Engineering, Equipment Engineering, Traffic Engineering.

Of course, the engineering organizations maintained by the larger telephone companies provide for the retention of a full complement of engineers for each of these four subdivisions. In other words, these larger companies have so many problems of a highly specialized nature, that they can well afford to maintain a plant engineering department; a commercial engineering department; an equipment engineering department and a traffic engineering department.

In the case of the smaller and medium size companies, however, one man must be sufficiently well versed in all phases of telephone engineering to solve any problem that may be presented. As a matter of fact, equipment engineering has become highly standardized. Telephone subscribers, instruments, central office equipment, private branch exchange equipment and so forth, have been standardized by the splendidly equipped engineering staffs of the various telephone manufacturing companies. Hence, the operating executive of a small, or medium sized, company is rarely called upon to solve equipment engineering problems. To state the matter a little more clearly: the operating executive is not called upon to design equipment, his work being done by he engineers of the manufacturing companies.

Commercial and plant engineering—at least insofar as the smaller companies are concerned—is somewhat closely allied.

The significance of the foregoing statement will be obvious if we review briefly the problems discussed in the opening installments of this series.

Assume the case of a rapidly growing town, with an old and entirely inadequate telephone system. First, viewing the problem from the standpoint of the commercial engineer, a general survey will be made of the town to determine its propensities from the standpoint of future telephone growth. The result of this survey may show that one section of the town will be devoted exclusively to business and commercial purposes while other sections may be classified as "first-class residential," "second-class residential" or "manufacturing."

The results of the preliminary commercial survey should present a "bird's-eye view" of the present, and the expected future, development from a telephone standpoint.

Differentiating the Duties

It is hard to draw a sharp line of demarkation between the final task of the commercial engineer and the initial tasks of the plant engineer. After the preliminary, commercial survey has been made, as will be remembered from reference to the earlier installments of this series, a population study is made. Census data is accumulated for twenty or more years prior to the date of the study and this data is supplemented by the censi made by school authorities or Chambers of Commerce, etc. In other words, it may happen that the survey is made nine years after the last U. S. Census. In such a case, it would be desirable to supplement the data resultant from the last census (and from previous U. S. censi) by all available data, resultant from the censi made by local civic bodies.

After the population data has been accumulated in its entirety, a curve will be plotted, and this curve extended to present a forecast as to probable future increases in population.

On the same sheet, another curve should be plotted (to suitable scale) showing the telephonic growth for the community under consideration. This growth curve, also, should be projected so that an estimate may be obtained as to the probable future telephone growth. In connection with this latter "projection" it should be remembered, however, that the ratio of telephone subscribers to population is constantly increasing. In other words, a ratio of one to five (one telephone subscriber to every five people) may have prevailed for sometime past in the community for which the study is being made. It should not be assumed, however, that this same ratio will prevail in the future. Year by year, the telephone is becoming a more important factor in our social and business intercourse and it is but natural that the telephone rate of growth should be more rapid than the population growth rate.

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All of these factors must be taken into consideration in connection with the preliminary commercial and plant engineering studies. It will also be remembered that these studies are so constituted as to forecast the probable numbers of telephone subscribers at the end of a 15 or 20 year period. The data resultant from these studies is used as a check upon the data obtained from the other plant engineering studies.

First Steps in Plant Engineering

Probably the first really practical step in plant engineering work involves the "house-count" study. In connection with the house-count study, it will be remembered that each town or city block is individually surveyed and the following data recorded for each property unit:

(1) Present classification of property —whether first or second-class business, or first or second class residential, manufacturing, etc.

(2) Probable changes in property classifications, or at least those changes which are apt to take place during the five-year period. In this connection, it may be said that the actual field survey often will show that single-family, residential property is to be replaced by hotels or apartments, or that a certain area is gradually changing from a residential section to a business section.

(3) In making the individual house-count studies the present numbers of subscribers should be indicated; as well as the expected number at the end of the five-year period, and some estimate should be made as to the expected number of subscribers at the end of the ultimate period. In recording this data, due consideration should be given to present, and probable future, service classifications.

It will also be remembered that the data resultant from the house-count study should be transcribed to suitably scaled city maps.

Working Basis for a Lay-Out

After the numbers of telephone subscribers for the present, five-year and ultimate periods, have been transcribed to the individual blocks on the city maps, ratios of lines to stations should be determined for the present, five-year and ultimate periods. Knowing these ratios, the number of lines per block may be determined for each period.

We now have a working basis for making a theoretical lay-out of a rather comprehensive nature. This "lay-out" should show present and proposed central office locations; present and proposed feeder cable routes and present and proposed distribution routes.

It will be impracticable to review, in detail, the method of determining proposed central office locations in the space allotted to this article. It is suggested, however, that if any questions arise in the reader's mind as to this phase of the problem, he again review the installments devoted to the location of central offices and the selection of primary and secondary feeder routes.

After the theoretical plant has been laid out, carefully, upon a suitably scaled map, there comes the problem of comparing the theoretical lay-out with actual conditions. To illustrate, it may be found that the theoretical feeder plan calls for a 16-duct subway on a certain street or avenue. In comparing the theoretical plan with the existing facilities, however, it may be found that a 10- or 12-duct subway (of sufficient capacity to serve the territory involved for sometime to come) is located on an adjoining street. In such a case, the theoretical plan should be modified according to the dictates of common sense, so as to make maximum use of existing facilities.

The First Work to Be Done

Next comes the problem of deciding what portion of the theoretical plant should be installed at once to relieve existing congestion and what portions can be deferred until the end of the five-year period, or possibly later. In connection with this phase of the problem, very careful consideration should be given to the question of annual charges; or, to state the problem more technically, the present worth of a dollar spent at some future date should be determined as accurately as possible.

The first step, in connection with the plant engineering problem, involves the preparation of working plans, specifications and bills of materials.

It is thought that the foregoing brief resumé of the subject matter discussed during the past twelve months, will serve as a connecting link between the engineering phase of the plant problem and the construction and maintenance phases, the discussion of the latter to be started in our next installment.

Helsingfors Contracts for German Automatic

Helsingfors, Finland.—An automatic telephone exchange to serve from 20,000 to 30,000 subscribers has been contracted for by the local Telephone Association. Siemens and Halske will supply the equipment. First installation, consisting of 2,000 lines, is to be in service in 1924.

This Is Why the Editor Left Town

In the February issue of TELEPHONE ENGINEER a photograph of O. D. Street, formerly General Manager of Distribution for the Western Electric Co., was run by mistake as a portrait of Frank Gill.

OUR LITERARY DIGEST

Review of Recent Articles on the Telephone and Allied Subjects

The Lead Cable Borer or "Short Circuit Beetle" in California, by H. E. Burke, Entomologist; R. D. Hartman, Field Superintendent in Insect Control, and T. E. Snyder, Entomologist, U. S. Department of Agriculture, Bulletin No. 1107.

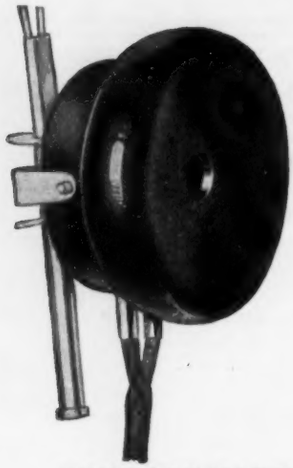
From time to time articles have appeared in technical journals throughout the world describing injury to metals by boring insects. Cases have been known where insects have eaten off the fuse wire in telephone fuses and made replacement necessary just as if the fuse had been blown. The first reports of damage to lead cables was received from California and similar cases were reported later from Texas. A few cases have appeared in other parts of the country.

The insect causing most of the damage was identified as a wood boring beetle (Scobicia declivis Lec.). The bulletin gives a detailed account of the life cycle of the beetle and of its habits. A number of control experiments which were made in co-operation with the American Telephone and Telegraph Co. and associated companies are described including tests in California and Virginia. Test cables having sheaths of various compositions and coated with various preparations were used in test cases and special cages were built around service cables.

The results of the experiments show conclusively that the beetle is able to bore through lead sheath but no conclusions were reached as to the cause of the attack. The greater part of the damage occurs at cable hangers as the cable borers must have a foothold from which to work. The experiments indicate that the borer can penetrate any alloy that is used as cable sheath and can go through any poison placed on the sheath. Grease or grease compounds give a method of control which is theoretically promising, beef tallow apparently being the best grease for the purpose. Layers of friction tape and thin sheets of copper, zinc and steel impede or prevent the boring but the cost is too great for general use.

Iowa Plans Great State Convention

Des Moines, Iowa.—President Parker of the Iowa Independent Telephone Assn., Secretary Charles Deering, and other of the active spirits in the Iowa organization have completed plans for what is hoped to be the state's most successful convention. It will be held at Des Moines, April 24-26.



KELLOGG RADIO

Several Reasons Assigned For Its Excellence

Listening to the best radio concert or most interesting lecture imaginable may become tiresome unless one wears a head set of exceptional lightness and convenience. Simple adjusting features, lightness of band, and comfort in wearing are to be considered when buying a head telephone that is to be worn by the hour. The Kellogg Bakelite receiver shell is non-metallic and all terminals are entirely enclosed. The cap's concave surface is the result of years of practical telephone receiver construction. Its diameter is 2 3/16 inches, and it screws into place with heavy threads which will not allow the cap to slip in ordinary usage. When two people desire to use one set or one receiver, the head band is instantly removable and as equally easy to replace. The magnet of the Kellogg radio head set is special tested steel and is hardened by a special method

Kellogg Equipment that Makes Successful Bid for Radio Business

and process which controls the heat and time, electrically and mechanically. The magnet windings are of great accuracy, the mountings, end plates, wire, insulation and insulating of the wire being all of the highest grade and of best material. Kellogg tested diaphragms are of the correct thickness for this work, and the assembled receiver of most dependable character, giving a service that many users claim is superior to any other type of radio receiver. Code No. 69A head sets are wound to 1,200 ohms per receiver; 2,400 ohms per set. The shell of Kellogg Bakelite is unbreakable in ordinary service. It will not discolor, warp or crack.

Men, women and children never before tried to make wagons, sewing machines or automobiles for their own use, but many, indeed, have tried to build radio sets. They have learned that an efficient product requires experience, in designing, in selecting raw materials, in manufacturing, assembling and inspecting—in fact, experience in all stages to the ultimate consumer. So we can better appreciate why some radio sets are good, some bad and some indifferent. Their value varies with the experience and the material that have gone into them. Kellogg Switchboard and Supply Co., with

many years of high reputation in the Independent telephone field, have been working steadily perfecting a line of radio equipment which can be absolutely depended upon. In this work, their long experience in production, wide research facilities, laboratories and skilled engineering department, and above all their thoroughness, have been of wonderful help. They intend that each and every piece of Kellogg radio equipment shall give satisfaction. Kellogg has long said of its telephones: "Use is the test." The same holds true of Kellogg radio.

Granges Help Rebuilding of Storm-Wrecked Lines

Belvedere, Ill.—Granges and individuals in the farm districts volunteered their services in rebuilding the recently wrecked lines of the Boone County Rural Telephone Co.

The "Convenophone" Wall Bracket Telephone Holder

Chicago, Ill.—The "Convenophone" wall bracket telephone holder has been designed in response to requests by telephone companies for such a stand. The telephone desk set when placed on the Convenophone is always put back and out of the way, off the desk, so that the set does not become injured and the cord does not become tangled. In effect, one has all the advantages of an extension arm. These stands are, probably, more in demand for the home than for the office, as the home telephone generally can be taken care of by a small bracket shelf of this kind. The bracket can be furnished with a coin slot for slugs and a memorandum pad, which may be renewed. It is suggested that this is a very practical holder for telephone companies to place with their subscribers. The memorandum pad may carry terse instructions regarding the use of

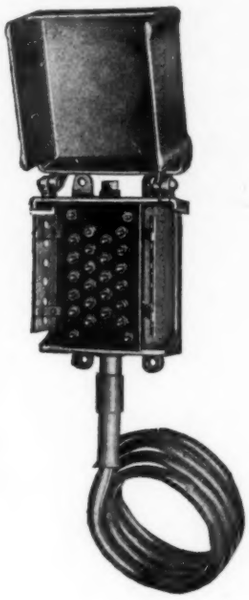
The Convenophone

the telephone and could be renewed by the telephone company. Live managers can work this device into a helpful adjunct to their service—not to mention the increase in revenue. Colytt Laboratories, Chicago, which make the "Convenophone" also manufacture the "whispering" mouthpiece, which has been described before.

Rubber Insulated Metals Corp. Moves to Newark

Newark, N. J.—The Rubber Insulated Metals Corp. has moved its general offices from 50 Church St., New York, to 18 Oliver St., Newark, N. J. This concern manufactures "RIMCO" rubber insulated pliers, screwdrivers, and other tools, known as "the safety tools," for linemen and high-tension work. The new location will give the Rubber Insulated Metals Corp. larger accommodations and afford facilities for handling a steadily increasing business.

G R Pole Cable Terminals



Cast Iron
Hot-Galvanized
Weather-Proof
Accessible
Husky Lock-Nut
Binding Posts
Lead Sleeve
Protects
Cable Stub
Maple Panels
No Sweating
No Leakage

Reliable Electric Company

3145 Carroll Avenue, CHICAGO, ILLINOIS

Greek Ministry Approves Reconstruction and Extension

Athens, Greece.—Entire reconstruction and development of the Greek telephone system by private interests has just been decided upon by the Greek ministry. The reconstruction covers the placing underground of the present overhead line system and the installation of modern central exchanges. Athens, Piraeus and perhaps Saloniki will first be completely equipped with a modern telephone system and the work is to be extended later to all cities and towns of 10,000 inhabitants. All the cities are to have intercommunication by direct lines; at the present time there is direct communication only from Athens to Patras and Saloniki. The existing telephone systems in Greece, according to Commercial Attache Hall, of the United States Department of Commerce, render poor service and yield only meagre financial returns. At Athens the number of subscribers is only 2,140, connections are unreliable and the talking qualities poor. Ordinarily no attempt is made to get Piraeus, only a few miles away, and even in the city it is quicker to write and send a messenger rather than attempt to do business over the telephone. The annual cost of the present telephone service to subscribers varies from 250 to 500 drachmas (1 drachma equals 1.2c). No toll system is in effect over such intercity lines as have been built.

"FARADAY" LAUNCHED

Successor to Famous Cable-Ship Slides Down the Ways at British Shipyard

London, England.—At Palmer's Jarrow yards the Faraday, the second cable ship of that name, was launched. It was christened by Mrs. G. Mure Ritchie, wife of the chairman of Siemens Brothers & Co., Ltd., its owners.

The first cable-ship Faraday sailed its first voyage in connection with the laying of the direct U. S. cable in May, 1874, and finished, last year, an adventurous career of achievement. Its successor is one of the largest and most modern vessels of its type afloat. It has a steaming radius of 10,000 miles. It employs oil fuel. Its cable carrying capacity is 4,500 tons.

Every facility for laying and repairing cable is included in the ship's equipment.

Southern New England Telephone Co.'s Growth in 1922

Hartford, Conn.—The Southern New England Telephone Co. which operates in Connecticut has just issued its annual report. The report shows increases in traffic and station growth in the last six months of 1922 and an average activity somewhat greater than that of 1921. The company now operates 198,903 stations, a growth during the year of 33,076. Additional capital stock to the amount of $3,000,000 was issued, making the total outstanding $18,000,000. The company now has 4,409 stockholders and 3,724 employes. Gross earnings were $8,344,000 and telephone operating expenses $2,286,000. Net earnings after deductions were $1,429,652.25, of which $1,316,704.00 were paid out in dividends and the balance credited to corporate surplus.

Southern Reports Reflect Improved Business Conditions

Atlanta, Ga.—The annual reports of the Southern Bell Telephone and Telegraph Co. and the Cumberland Telephone and Telegraph Co. have been issued from the general offices of the companies at Atlanta, Ga. Both companies report a marked increase of exchange and toll business, reflecting the improved business conditions in the South. Net plant additions for the Southern company were $3,065,694 and for the Cumberland company $2,400,104.

MECHANICAL TABLES (BB-9-25)

Standard Wire and Sheet Gauges
Thickness in Decimals of an Inch

No. of Gauge	Browne & Sharpe (Elect.)	Birmingham	U .S. Stand. Iron-Steel Plate	British Imperial	American Steel & Wire	Trenton Iron Company	Stubs Steel Wire
			0.50000	0.500	.....	.....	....
7°	.....	....	0.46875	0.464	.....	.....	....
6°	.....	....	0.43750	0.432	.....	0.450	....
5°	.....	....	0.40625	0.400	0.3938	0.400	....
4°	0.460	0.454	0.37500	0.372	0.3625	0.360	....
3°	0.40964	0.425	0.34375	0.348	0.3310	0.330	....
2°	0.36480	0.380	0.31250	0.324	0.3065	0.305	....
0	0.32486	0.340	0.28125	0.300	0.2830	0.285	0.227
1	0.28930	0.300	0.265625	0.276	0.2625	0.265	0.219
2	0.25763	0.284	0.250000	0.252	0.2437	0.245	0.212
3	0.22942	0.259	0.234375	0.232	6.2253	0.225	0.207
4	0.20431	0.238	0.218750	0.212	0.2070	0.205	0.204
5	0.18194	0.220	0.203125	0.192	0.1920	0.190	0.201
6	0.16202	0.203	0.187500	0.176	0.1770	0.175	0.199
7	0.14428	0.180	0.171875	0.160	0.1620	0.160	0.197
8	0.12849	0.165	0.156250	0.144	0.1483	0.145	0.194
9	0.11443	0.148	0.140625	0.128	0.1350	0.130	0.191
10	0.10189	0.134	0.125000	0.116	0.1205	0.1175	0.188
11	0.090742	0.120	0.109375	0.104	0.1055	0.1050	0.185
12	0.080808	0.109	0.093750	0.092	0.0915	0.0925	0.182
13	0.071961	0.095	0.078125	0.080	0.0800	0.0800	0.180
14	0.064084	0.083	0.0703125	0.072	0.0720	0.0700	0.178
15	0.057068	0.072	0.0625000	0.064	0.0625	0.0610	0.175
16	0.050820	0.065	0.0562500	0.056	0.0540	0.0525	0.172
17	0.045257	0.058	0.0500000	0.048	0.0475	0.0450	0.168
18	0.040303	0.049	0.0437500	0.040	0.0410	0.0400	0.164
19	0.035890	0.042	0.0375000	0.036	0.0348	0.0350	0.161
20	0.031961	0.035	0.0343750	0.032	0.03175	0.0310	0.157
21	0.028462	0.032	0.0312500	0.028	0.02860	0.0280	0.155
22	0.025347	0.028	0.0281250	0.024	0.02580	0.0250	0.153
23	0.022571	0.025	0.0250000	0.022	0.02300	0.0225	0.151
24	0.020100	0.022	0.0218750	0.020	0.02040	0.0200	0.148
25	0.017900	0.020	0.0178500	0.018	0.01810	0.0180	0.146
26	0.015940	0.018	0.0171875	0.0164	0.01730	0.0170	0.143
27	0.014195	0.016	0.0156250	0.0148	0.01620	0.0160	0.139
28	0.012641	0.014	0.0140625	0.0136	0.01500	0.0150	0.134
29	0.011257	0.013	0.0125000	0.0124	0.01400	0.0140	0.127
30	0.010025	0.012	0.0109375	0.0116	0.01320	0.0130	0.120
31	0.008928	0.010	0.01015625	0.0108	0.01280	0.0120	0.115
32	0.007950	0.009	0.00937500	0.0100	0.01180	0.0110	0.112
33	0.007080	0.008	0.00859375	0.0092	0.01040	0.01000	0.110
34	0.006304	0.007	0.00781250	0.0084	0.00950	0.00950	0.108
35	0.005614	0.005	0.00703125	0.0076	0.00900	0.00900	0.106
36	0.005000	0.004	0.00664063	0.0068	0.0	0.00850	0.103
37	0.004453	0.0	0.00625000	0.0060	.....	0.00800	0.101
38	0.003965	....	0.0	.....	.....	0.00750	0.099
39	0.003531	....	.....	.....	.....	0.00700	0.097
40	0.003144	....					

ALTERNATING CURRENTS (EE-1-20)

Elements of Alternating Currents

DEFINITION. An alternating current is one which periodically reverses its direction of flow, rising from zero to a maximum in one direction, then diminishing gradually to zero, and then rising to a maximum in the opposite direction. A graph or diagram of this current is similar to that of a helix or screw thread projected upon a flat surface, the curve of the current describing simple harmonic motion in which the instantaneous value is proportional to the sine of the angle of the rotating tracing point. For this reason the elementary alternating current wave is known as a "sine wave," and unless otherwise specified, a sine curve is always assumed in alternating current calculations.

An elementary alternating current is considered as being developed by the rotation of a conductor in a uniform magnetic field. With a uniform rate of rotation, the current gradually rises to a maximum and then declines to zero during one-half the revolution, and then passes through a similar cycle, but in the opposite direction during the second half of the revolution. The total height reached by the current or voltage (Maximum value) is the "amplitude" of the wave. At any other point in the revolution, the value of the current curve is proportional to the sine of the angle made by the conductor with the zero reference line. In practice, however, the alternating current wave is seldom a true sine wave owing to the fact that the magnetic field of the generator is seldom uniform and hence the outline of the wave is distorted by the variations in the field. For purposes of calculation in ordinary circuits, the assumption of the true sine wave, however, gives results close enough for practical purposes.

A complete alternating current CYCLE consists of a complete series of events in the circuit or consists of both outward and inward flow impulses. A cycle comprises both positive and negative waves, or is the period during which a double reversal takes place. A single wave, either positive or negative, is an ALTERNATION and is represented by that period during which current flow takes place in one direction. Therefore, a cycle consists of two alternations, and the number of alternations are twice the number of cycles. The rate at which the current reverses may be given in terms of CYCLES PER SECOND or as ALTERNATIONS PER SECOND, but common usage in this country gives preference to the former.

GENERAL PROPERTIES OF A. C. CURRENT. As equal current impulses flow in opposite directions through the circuit, and alternating current has no electrochemical effect. For this reason, alternating current can not be used for charging storage batteries nor for other electrolytic processes which involve chemical decomposition by electrolytic means. As with direct current, the alternating current produces a heating effect when passed through a resisting path, and possesses the same properties of magnetization with the exception that the alternating current flux alternates in step with the current alternations.

In a non-inductive circuit, that is a circuit consisting of pure ohmic resistance, the current at any instant is proportional to the impressed volts just as with a direct current. The waves of amperes in this case reach their maximum and minimum values at the same instant that the curve of volts becomes maximum and minimum. In this case the voltage and current waves are said to be "in phase."

When the circuit contains inductive reactance in addition to the ohmic resistance, as in long lines or circuits containing electromagnets or solenoids, one portion of the impressed voltage may be considered as consumed in ohmic resistance while the other part in the counter e. m. f. of the inductive reactance. Here, the portion of the e. m. f. consumed in the reactance is no longer in phase with the current, but the voltage wave occurs slightly ahead of the current wave. The magnetic flux interlinked with the circuit is in phase with the current impulse which produces it. The e. m. f. generated in the reactance is proportional to the rate of change of the magnetic flux, and since the latter is greatest when the value passes through zero, the e. m. f. is in quadrature with the flux and also with the current.

Why they stick

On the ground floor of the telephone building a man worked at the test board. It was night; flood had come upon the city; death and disaster threatened the inhabitants. Outside the telephone building people had long since sought refuge; the water mounted higher and higher; fire broke out in nearby buildings. But still the man at the test board stuck to his post; keeping up the lines of communication; forgetful of self; thinking only of the needs of the emergency.

On a higher floor of the same building a corps of telephone operators worked all through the night, knowing that buildings around them were being washed from their foundations, that fire drew near, that there might be no escape.

It was the spirit of service that kept them at their work—a spirit beyond thought of advancement or reward—the spirit that animates men and women everywhere who know that others depend upon them. By the nature of telephone service this is the every-day spirit of the Bell System.

The world hears of it only in times of emergency and disaster, but it is present all the time behind the scenes. It has its most picturesque expression in those who serve at the switchboard, but it animates every man and woman in the service.

Some work in quiet laboratories or at desks; others out on the "highways of speech." Some grapple with problems of management or science; some with maintenance of lines and equipment; others with office details. But all know, better than any one else, how the safe and orderly life of the people depends on the System—and all know that the System depends on them.

"BELL SYSTEM"

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

AND ASSOCIATED COMPANIES

One Policy, One System, Universal Service, and all directed toward Better Service

EIGHT-HOUR LAW
Telephone Operator Thinks No Such Law Is Needed

Springfield, Ill.—One of the operators of an Illinois telephone company recently wrote a letter to members of the Illinois legislature from her district protesting that an eight-hour law is not needed in the telephone industry. Her letter follows:

"As a telephone operator, I emphatically protest the 'Eight Hour Law on Telephone Service and Telephone Female Employees,' as being detrimental to the public and company also. The situations with the telephone company are not comparable to those with which factories and mercantile businesses must cope. Our work is quite different and laws which might benefit factory employees, are not applicable to telephone operators. The latter are not classed with the former and the same law cannot govern both.

"The working hours of a telephone operator are so arranged as to give two minimum relief periods of fifteen minutes each during a period of eight hours. With a two hours' luncheon period, any ordinary operator under ordinary conditions is fit in every way and quite willing, if necessary, to operate a period of overtime not to exceed two hours, making the maximum period ten hours.

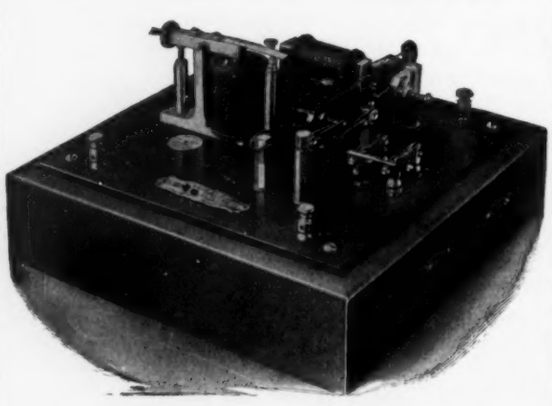
"In cases of emergency, the telephone is foremost in the mind of the public because of the rapid means of communication. Rapid and efficient service is required. In effecting the "Eight Hour Law" this valuable service would be greatly impaired. For instance, an unavoidable delay might detain the night operator who relieves the day operator. An important call is being completed, transmitting the acceptance of an important contract. At the end of eight hours the day operator must release her circuit, suspend all work on the call and leave the exchange building immediately. The call is later completed by the night operator, when she arrives; but the contract has been closed with another. Lack of prompt and efficient service has lost the contract and, perhaps, thousands of dollars for the subscriber.

"Constant demand and imperative need of telephone service by the public creates a situation not attainable by any other business. We operators do not declare a holiday and journey to the woods for a day's outing. That is utterly impossible. Our doors are always open and our lines are always ready to serve at any minute, day or night. During special events, such as annual celebrations, conventions, meets, etc., our lines are pressed with heavy traffic, which requires more operating. It is impossible to retain extra operators, since the work is so small. One who does not work daily is not efficient. Enforcing the eight hour law would impair the service to a great extent. During the year 1922, I was absent from the telephone office three weeks. My total overtime amounted to less than eight hours and I worked each and every time I was asked and as much overtime as any other operator.

"The working conditions of a telephone operator are not to be compared with a factory employee. The factory is a smudgy, dusty, noisy place with very little room. Our telephone office is a large roomy building with windows all around and equipped with electric fans, which render the room cooler than the average place of business. Why is a telephone operator not fit in every way to operate for a period of overtime not to exceed two hours?

"I, as an operator, for three years in the traffic department of one of the large telephone companies of Illinois, protest the proposed 'Eight Hour Law on Telephone Service and Telephone Female Employees' as being detrimental to the public and all concerned."

Warner Pole Changer



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Not the familiar instrument on your desk or wall. Special needs have demanded special types. To help develop these, a skill gained in 46 years of making telephones has been called into play.

Western Electric is the oldest and largest manufacturer of telephones in the world.

Western Electric

Since 1869 Makers of Electrical Equipment

IT HELPED WIN THE WAR. Telephones like this played an important part in reporting enemy movements along the Western front. For peace or war, the opportunity of airplane telephones to render real service, helps to make our job of producing them an interesting one.

"PUMPS OUT OF ORDER." An emergency call from a mile below ground. The mine telephone has warned in time to prevent many a disaster. Western Electric people like to think of this help when they are making the instruments.

STALLED A HUNDRED MILES FROM NOWHERE. Conductor tapping in on the wires with a portable telephone, to call for help. Used by track inspectors, too, to report washouts, here is another Western Electric product which is saving lives.

LIKE SPEAKING TWO FEET AWAY. Every syllable loud and distinct. The Public Address System makes it possible for speakers to talk to tens of thousands. This remarkable product of the inventor's genius and the manufacturer's skill carries a whisper for blocks.

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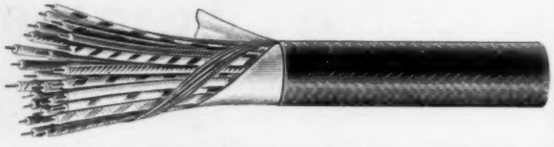
FOR SWITCHBOARD
AND
INTER-PHONE WORK



Cables are made of tinned copper or enameled copper wire, insulated with the highest grade of Tussah Silk and long staple cotton.
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"Telephone Transmission Over Long Cable Circuits," by Alva B. Clark, American Telephone and Telegraph Company. Journal of American Institute of Electrical Engineers, Jan., 1923.

This paper discusses some of the factors that affect transmission over long cable circuits. For such cables two types of loading known as "medium heavy loading" and "extra light loading" have been developed. The characteristics of cable conductors with these types of loading are given. Due to the fact that an appreciable time may be required for the speech to pass over the line an effect very similar to "echo" is produced and the causes and methods of reducing these echoes are discussed.

Other characteristics of long cable circuits are discussed including power levels, causes of distortion, transient phenomena and stability of circuits. The tests and adjustments of repeater apparatus are given and the circuit of a device for measuring transmission gains due to repeaters is shown. Another device described for the first time is the automatic transmission regulator. This device utilizes a pair of pilot wires in the cable.

The pilot wires are connected to a Wheatstone bridge arrangement and as the resistance of the pilot wires change with change in temperature the bridge adjusts itself automatically at the same time controlling the gains of the telephone repeater. In this way the differences in transmission due to change of temperature of the conductors are compensated automatically by changes in repeater gains.

OUR "LITERARY DIGEST"

Review of Recent Articles on Telephone and Allied Subjects

"Telephone Erection and Maintenance," by Herbert G. White, S. Rentell and Co., Ltd., London, price 3-6 net.

This is a third edition of an English handbook that is particularly designed for use of the electrical contractor or the installer of isolated systems. It makes no attempt to give a discussion of the telephone systems in use in public exchanges. The systems described are those found in England and what seems to be rather complete information is given. A general idea of the contents may be obtained from the chapter headings. The first three chapters are devoted respectively to House Bell Circuits, to Battery Ringing Telephones and to Magneto Call Telephones. Three chapters are devoted to the various systems, Intercommunication Systems, Secret Intercommunication Systems and Switchboard Systems. The final two chapters deal with Instrument Erection and Line Construction and with Testing and Fault Location. The material is well arranged and the descriptions of the systems and their operation is given clearly so that they may be understood by those who only occasionally are called upon to undertake the installation work on a private telephone system. That the book is serving the purpose for which it was written is evidenced by the fact that it has reached a third edition, something rather uncommon in telephone books.

The telephone directory is pushing the Bible for first honors for large circulation. There are now 17,716,500 "Hello" books published each year by the Bell system alone. There are 2,500 different directories, each of which is published twice annually, requiring 41,725,000 pounds of paper costing $1,922,575. The total expense of publishing this immense amount of information and guidance for the talking public is $8,134,750.

A Strong Pull vs. Main Strength and Awkwardness

BOTH trucks are standing still but one is busy while the other is doing nothing.

The **busy** truck above is being loaded by means of its own Mead-Morrison Underslung Winch, which also sets poles and hauls cables with equal speed and efficiency.

The **idle** truck below is idle because it has no winch. So you see a gang of eight men wasting time on the slow and costly process of pole raising with pikes where three men with a winch could make a quick job of it.

The upper view also shows the advantage of position of the Mead-Morrison Winch under the rear of the truck, ready for instant use but **out of the way of the load.**

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MEAD-MORRISON WINCHES

FOR CABLE HAULING AND POLE SETTING

Telephone Talks

No. 2

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Manganese dioxide of various grades give different results according to the capacity of the chemical to enter into reaction with the other materials in the cell. The chemical action is of a rather complicated nature and could not be covered within the confines of this column.

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are made with an exclusive grade of manganese dioxide, from mines that serve as a source of supply to no other battery manufacturer.

Furthermore, the manganese dioxide that goes into Victor Cells is specially treated at the factory.

The result is conclusive proof of the value of this manganese dioxide. Victors regain from 20% to 30% more strength after use than any cell on the market.

That's why, in addition to costing less per barrel, they cost less per day's service.

THE CARBON PRODUCTS CO.
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"GET TOGETHER" FOR SERVICE

Massachusetts Telephone Chief Emphasizes "Let's Sit Down and Reason Together"

Boston, Mass.—A "Get Together" spirit is needed for the improvement of telephone service, is the belief of William H. O'Brien, chief of the Telephone and Telegraph Division of the Public Utilities Commission of Massachusetts, as is indicated from press reports of his recent address before the Rotary Club of Boston. Mr. O'Brien gave some interesting statistics of the telephone business in Massachusetts, stating that out of a total of 687,000 telephone stations in the entire state, 343,000 were located in the metropolitan division. Over 397,000 subscribers are on party lines.

In his division of the commission work, more than 2,500 complaints were handled during the past year in the spirit of "let's sit down and reason together." Out of 100 people, 95 were found to be fair and reasonable if the truth is told and cards are laid on the table. As a rule, the average man is not concerned about rates, within reason, but rather with service. Most of the complaints with which his department has to deal result from poor service, particularly in wrong numbers and from failure to make installations promptly.

While the telephone companies have been at fault in some respects, the average business man also has failed to protect his telephone service by permitting his service to be used only for business and the average residence subscriber has been at fault by insisting on using his telephone to the exclusion of his neighbor who is on the same line.

Unimportant social calls over business telephones have resulted in complaints that the line was reported busy when people were trying to get in on the line for a business call. The responsibility for poor service in this case rests upon the business man who permits his line to be used for social and unimportant matters.

Wrong numbers are caused by the operator who leaves the line before she gives the subscriber a chance to correct a number that she has repeated incorrectly and by the subscriber who talks anywhere but into the mouthpiece. This may result in the necessity of the operator having the number repeated two or three or even four times or in her taking a chance that she has it right and completing what later turns out to be a wrong connection.

He emphasized a matter which has occupied the attention of his department for several years, that of the necessity for some action in the case of the subscriber who insists on using his line as long as he pleases to the exclusion of his neighbor. This is one of the most difficult propositions that the company has to deal with and the campaign that the company is making to remedy conditions has the complete and hearty co-operation of the telephone department of the Commission.

The speaker stressed two points, the unnecessary use of the telephone and the development of the spirit of "let's sit down and reason together." When this is done there is scarcely any condition where men cannot find a common ground for the adjustment of difficulties in a manner satisfactory to all concerned.

Manteca (Cal.) Plant Sale Is Authorized by Commission

Sacramento, Cal.—C. W. and M. A. Forbes have been authorized by the Railroad Commission to sell to the Manteca Telephone Co. the property owned by them as the Manteca Telephone System.

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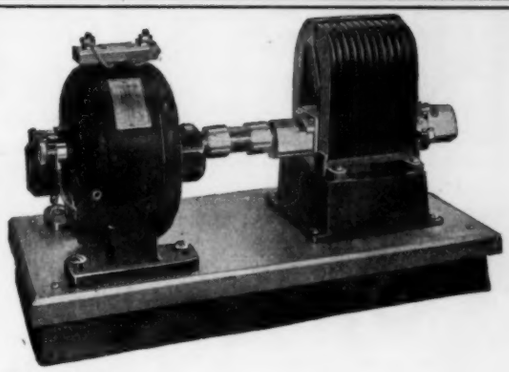

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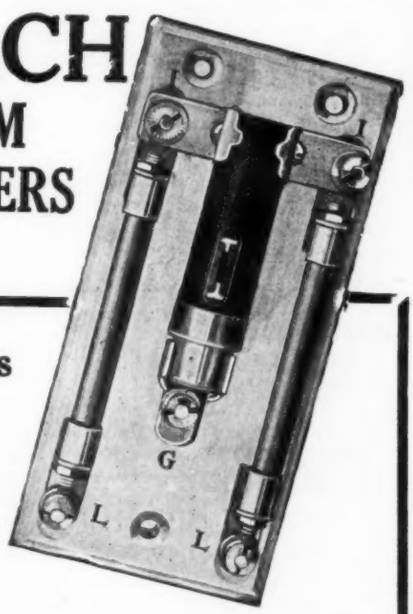

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RESPONSIBILITY

What It Means to the Repairman —His Obligations, Study and Conduct

The repairman's responsibility constitutes three obligations: What he owes the public whom he serves; the company for whom he works, and himself.

How is he going to fulfill these obligations?

To the public he must first, last and always give the best service possible. To do this he must educate himself in the telephone business to the end that he may render intelligent and efficient service.

Let him compare himself with a doctor of medicine or surgery who before he can render service must know each part of the human anatomy and its functions, and is trained to recognize causes and effects by symptoms.

The repairman, to be a good one, must study. He must train himself to become familiar with the functions of every mechanical organ of the telephone anatomy, and must be able to recognize causes and effects by the symptoms. A doctor uses his stethoscope, the repairman his test set to "sound" their respective troubles where they are not visible. Some doctors guess at the cause—so do some repairmen, but the doctor ordinarily has the advantage over the repairman in that the latter is usually called upon to show immediate results.

The repairman owes it to the public to train himself in his work so that when he is called upon to repair their apparatus he can diagnose the trouble quickly and with as little inconvenience to them as possible.

Illustrative of the second obligation: "The company for which he works"—he owes it to the company to take advantage of everything it produces for his education. If he does not utilize this opportunity he not only cheats himself, but he also cheats the man he works for.

Since he is constantly in personal contact with the public, his conduct forms the basis of the opinion which the public has of the telephone company. We all know that when a man is out in the business world his training is reflected by the manner in which he conducts himself. Therefore, if the public is to believe we are a courteous and efficient organization, he must instill that feeling by courteous conduct at all times. He should keep in touch with activities taking place in the business so that when he is questioned by the public he can answer intelligently. This not only reflects favorably upon the company, but also gives them a better opinion of us—no man can afford to ignore public opinion.

The repairman should at all times work in harmony with his fellow workers, for it is only by working hand-in-hand that we can accomplish the best results. There are other factors which might properly be enumerated here, but we have given the most important ones and the others will automatically suggest themselves.

What does the repairman owe himself? First of all he must keep fit by observing the rule of safety first. At no time should he jeopardize his well-being, the well-being of fellow employees or others by his carelessness. Whenever he meets a condition where there is a likelihood of an accident, he should have the condition corrected.

Nearly all repairmen are family men, therefore they owe it not only to themselves but to their families to bring themselves to the highest pinnacle of efficiency so that when the opportunity for promotion presents itself they will be ready. The future of their families depends largely upon how far they advance themselves.

If they fulfill these obligations they may rest assured that they are doing their job.—Edgar A. Wampole, in "Bell Telephone News."

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